SCIENCE.

FRIDAY, JULY 27, 1883.

THE ADVANTAGES OF STUDY AT THE NAPLES ZOÖLOGICAL STATION.

THE opening of the marine laboratory in Naples in 1874 marks an important epoch in the progress of biological studies, as seen, not only in the prodigious and ever-increasing amount of work which it produces, but also in the general interest which its success has inspired in other quarters. As in America seaside schools and laboratories may be traced to the example set at Penikese, so in Europe most of the marine laboratories owe their origin to influences emanating from Naples. But the beneficial influence of the Naples station is by no means confined to Europe. Already we hear of marine stations in Algiers, in Sydney, and in Java. In Japan too, as we are informed, a laboratory has been established by Professor Mitsukuri in a Buddhist temple, — an example the moral of which is easily drawn. Thus the prediction made by the founder of the Naples station, Professor Anton Dohrn, some ten years ago, — that marine zoölogy was destined to become paramount, and that the earth would soon be encircled by a net-work of zoölogical stations, — seems to be rapidly approaching its fulfilment.

Yours very sincerely
Anton Dohrn

Every one can now see that the Naples laboratory was a gigantic enterprise, magnificent alike in conception and in achievement, although few are aware of the magnitude and varied nature of the difficulties which opposed its progress. It is a matter for rejoicing, that this institution was planned on such broad and liberal views, and with such wise prevision of the course its development should take in order to secure a long and prosperous existence. With the addition of a physiological department now determined upon, it becomes a bio-

logical station in the broader sense of the word, — an organization on a grand scale for the study of marine life in all its aspects. Its brilliant career during the first nine years of its existence not only insures its permanency, but also gives pledge of future growth commensurate with the ever-expanding needs of biological research.

The station is no less liberal in its management than comprehensive in its aims; for it opens its doors to naturalists from all quarters of the globe on like conditions. It is the international character of the station, combined with the natural advantages of situation, which has made it, in so short time, the Mecca of biologists, and a seat of unprecedented prolific activity. The mild and equable climate of Naples, the unsurpassed richness of the fauna and flora of its bay, and the best equipped laboratory in the world, conspire to give the Naples station pre-eminence among institutions of its kind, and to render it probable that it will remain what it is now acknowledged to be, — the world's great biological station.

The detailed account given in Miss Nunn's valuable article (SCIENCE, Nos. 17 and 18) makes it unnecessary to enter here into a description of the laboratory; and Mr. Cunningham's excellent review of the work which it has already accomplished (*Nature*, March 15) is doubtless accessible to most of the readers of SCIENCE.

Let us rather consider the practical question of our own interest, as Americans, in this institution. Except in a single and noteworthy case of very recent date, we have thus far taken no active interest in this matter. The distance between us and Naples has seemed to foster the idea that we have no immediate and common concern with European nations in opportunities that lie so much nearer their doors than ours. But recent events have demonstrated that there *is* a demand on the part of American naturalists for just such opportunities as are now offered at Naples, and nowhere else; and with them political isolation is not likely to be mistaken for scientific isolation. That this demand does not arise from whimsical reasons will certainly be conceded by all who understand its meaning. Still there may be some who will ask if the field for investigation is not sufficiently broad at home, and the facilities for work sufficiently ample, to satisfy the requirements of American naturalists. With all due respect to such queries, we would suggest that they do not contain the gist of the matter: for even on the preposterous supposition that our facilities for biological research are fully as great as those at Naples, no one could claim that they are identical; so that it would still be pertinent to ask, Can we not profitably *add* the advantages in Naples to those enjoyed at home? The real question comes to this: Are there advantages at Naples which are not offered here, and are they worth the time and money required to obtain them? Now, it is no disparagement to home talent and resources, to say that the advantages of study at the Naples station are incomparably greater, and certainly more numerous, than those at our command. More than this, there is not a single laboratory in Europe where the student of natural history can pursue his studies under so favorable circumstances as at Naples. This is doubtless much to say, when we remember that the laboratories of Huxley, Lankester, Lacaze-Duthiers, Van Beneden, Leuckart, Haeckel, Gegenbaur, Claus, Semper, Kölliker, Barrois, and Giard are of world-wide repute; but it is not merely our private opinion, it is an acknowledged fact. Of course, we are not now speaking of the comparative merits of this institution for students just beginning their studies, but for those who are already more or less prepared for independent work.

The Naples station makes no pretension to fulfilling the functions of a school or a college: its aim is to advance biological research; and to this end it consecrates all its energies. It is a laboratory organized and equipped, not for training the inexperienced, but for aiding the investigator. It represents, in many respects, the excellences of all the best laboratories of Europe combined, and sur-

passes them all in the inexhaustible wealth of its resources, and in the many exceptional advantages that naturally spring from its international character.

Although no lectures or courses of instruction are provided for, an able staff of assistants are constantly employed, whose aid and counsel in all matters pertaining to methods of work leave nothing to be desired. It is one of the great advantages of work at the station, that it gives one opportunities for the acquisition of methods. An institution which pushes research with such energy and success will naturally be prolific in the discovery of ways and means. The station brings together a body of zealous workers from the best laboratories of Europe, and thus, besides giving a rare opportunity for the formation of valuable acquaintances, direct interchange of thought, and discussion of problems, opens another way for the accumulation and refinement of methods. It is in this way that it becomes a sort of international depot for the reception of discoveries and improvements made elsewhere. The heterogeneous material thus obtained is sifted, systematized, tested, further elaborated and refined, and redistributed. The methods of microscopical research published by Paul Mayer, and the well-known discoveries of Giesbrecht, show that the station is doing no less important work as an originator than as an accumulator and a distributer of methods.

Now, whoever knows the value of methods — and we need not argue with those who do not — will admit, that, in this particular, the Naples station is unrivalled, and that, from the nature of things, it will probably remain so indefinitely. However successful we may become in the development and application of methods, we are not likely to see the time when it will not be desirable to see, and to know by experience, how work is done at Naples. This one but all-important matter, to say nothing of the many other advantages that must accrue to an occupant of a table at the station, — such as social intercourse, direct knowledge of a very important fauna, and opportunities of acquiring a knowledge of the four languages with which every naturalist must now be familiar, — makes it very desirable, particularly for our younger naturalists, to spend some time at Naples.

One of the indispensable requisites to successful work in natural history is an extensive library; and this is precisely one of the needs most felt in seaside laboratories. As a rule, naturalists are compelled to select a few of the books which they conjecture will be useful to them, and transport them to the place of study. This method is, of course, very unsatisfactory, for reasons too obvious to be mentioned. The Naples station has met this difficulty by establishing a permanent library in an apartment adjoining its laboratory. Already this library has become one of the most complete biological libraries in Europe, and forms one of the chief attractions of the station. Its management, we are happy to say, is the least conspicuous thing about it. Those accustomed to depend upon public libraries, open only at stated hours, approached only through officials, and encumbered with rules, blanks, fines, etc., have a pleasing sense of relief on finding the doors of this rich library thrown open to them, with the liberty of helping themselves at any time to whatever books are desired, with no further requirement than to place a card bearing their name in the place of each book taken. This simple device enables others who chance to want the same books to know precisely where to find them.

The supply of material furnishes another topic well worth consideration in this connection. It is the method of supply, rather than its richness, which merits attention. An organized body of men is constantly employed for this purpose; and they make it their business not only to know what material can be obtained, but also when and where. These men now work with all the advantages of long experience and systematic training. The occupant of a table has only to announce what object he wishes to study, and it is delivered alive at his table. In this way the investigator is able to accomplish the largest

amount of work in a given time, and with the least possible annoyance.

The furnishing of the table also deserves attention. Within twenty-four hours after notice is given, one finds his table ready for use, supplied with drawing-material, a large variety of reagents, staining-fluids, and all the appurtenances required for the most difficult kinds of research. It is not the raw material that one finds on his table, but every thing actually prepared and ready for immediate use. Further needs are promptly supplied on request. Thus every thing is arranged to save the time of the investigator, and render his work as effective as possible. Compare these facilities for study with those offered anywhere else, and the contrast is at once apparent.

The conservator's department, under the direction of Salvatore Lo Bianco, has become one of unusual interest and importance; and the work it is doing deserves to be generally known in this country. The work of this department is the preservation of all the material brought to the station, except what is required to supply the tables and the public aquarium. The success with which this most difficult business of preserving marine animals in lifelike appearance is accomplished, is certainly marvellous, and richly deserves the highest tribute of praise. This department is producing results of immense value to science, and its usefulness is now widely recognized. Its beautiful preparations adorn the shelves of nearly every museum in Europe; and it is constantly sending out supplies to laboratories for teaching purposes. Many naturalists who find it inconvenient to work at Naples are supplied by this department with material in such perfect state of preservation for anatomical and histological study, that they are enabled to carry out their investigations without once visiting the station. There are undoubtedly museums and laboratories in this country that would do well to avail themselves of this opportunity. This department has been created for the special purpose of serving science in the above-named ways, and not for increasing the funds of the station; and hence the preparations are made for a sum that scarcely more than covers the expense of the alcohol and other reagents used in their preservation.

There is still another way in which this department of the station might be of importance to this country. Doubtless some arrangements might be made between our naval authorities and the director of the station, such as have been made in the case of Germany and Italy, which would enable us to send an officer from time to time to the station, with a view to gaining a practical knowledge of the methods of preserving animals. In this way each of our war-ships might be supplied with one officer prepared to take advantage of the rare opportunities for advancing our knowledge of marine life which arise in the course of their distant cruises.

In view of the considerable number of American students in the biological laboratories of Europe, and the many applications on their part for permission to work at Naples, there has naturally been some surprise at the fact that America has hitherto declined to contribute any thing towards the support of the station. The honor of taking the first step towards rectifying our mistake in this matter belongs to Williams college. It is to be hoped that the example set by President Carter and the trustees of this college will not long remain the only evidence of our appreciation of the Naples station. Three or four tables will at least be required to meet the demands of our zoölogists alone, judging from the number now at work there. It is not right that American students should go to Naples as beggars, to be received out of courtesy, or indirectly through the liberality of English or German universities. Of the twenty-six tables now taken at the station, Germany controls twelve; Italy, four; England, two; Russia, two; Belgium, two; Holland, one; Hungary, one; Switzerland, one; and Williams college, one. There are four tables not yet disposed of, two of which, at least, should be secured at once by America. Will not some one or more of our universities take this matter in hand?

The establishment of a biological station at Wood's Holl, which, in the hands of Professor Baird, will doubtless be pushed to a speedy completion, will create facilities for the study of marine life on a much larger scale than we have hitherto seen in this country; and the successful issue of this enterprise, we venture to predict, will increase rather than diminish the number of American naturalists at Naples. Whatever improves our facilities for study will tend to increase the general interest in biology, and to augment the number of naturalists who will seek the best that the world affords in the way of methods. The time will never come when direct interchange of thought, and comparison of methods of research, will cease to be of the highest importance to the biologist. On the contrary, these things will become more and more a necessary part of the experience of every one who aims to be a useful and successful student of life. The progress of biological studies will soon create a demand for more than one international laboratory, and we certainly hope that the new station at Wood's Holl will take this character. The establishment of several great stations at different points, selected according to the relative richness and importance of the fauna and flora, each offering facilities for study similar to those enjoyed at Naples, and open to naturalists of every country, would prepare the way for a concentration and organization of forces, and inevitably raise the standard of work, and check the accumulation of drift-wood. It is obvious that the usefulness of one station would not be impaired by the existence of others, since the work of each would be supplementary to that of the others.

The character and importance of the publications of the station have been so well stated by Mr. Cunningham in the article before referred to, that little remains to be said on this topic. In looking over the list of subscribers to the *Fauna and flora*, we are again forced to acknowledge the slender interest which America has taken in the Naples station. Here is a colossal series of magnificent monographs, designed to give an exhaustive treatment of the plants and animals found in the Gulf of Naples, and published at a price that ought to insure them a place in the private library of every zoölogist and botanist in the country; and yet the list of subscribers, according to the last circular, numbers only eight. Even such countries as Holland and Switzerland outdo us. Austria and Russia have each twice this number of subscribers; Italy has nearly four times, England about five times, and Germany ten times, as many.

As our poor representation cannot be attributed wholly to indifference, it is safe to conclude that these monographs are not so generally known as they deserve to be. Thirty of the series have already been announced, six of which have been completed. From two to four are published each year in quarto form, and illustrated with numerous expensive plates, at an annual subscription-price of only twelve dollars and a half. The number of subscribers is now two hundred and seventy, and the three hundred and fifty copies of Dr. Chun's *Monographie der Ctenophorae* — the first in the series — have been already nearly exhausted. The monographs are written either in English, German, French, or Italian, according to the preference of the authors. Such brilliant achievements in the line of exhaustive research as are embodied in these monographs certainly command our homage, and assuredly deserve a more generous recognition than they have yet received in this country.

C. O. WHITMAN.

THE NATIONAL RAILWAY EXPOSITION.[1] — III.

IN England and Europe generally, signals of every conceivable variety have been used; but experience has shown that the semaphore is the best signal, and its universal adoption in Great Britain and on the busiest railways on the continent of Europe is a good example of the doctrine of the survival of the fittest. The exposition, we regret to observe, contains many forms of signals that are neither distinct in appearance nor positive in meaning. It is hard to say whether some of them mean safety or danger. A mere change

[1] Continued from No. 23.

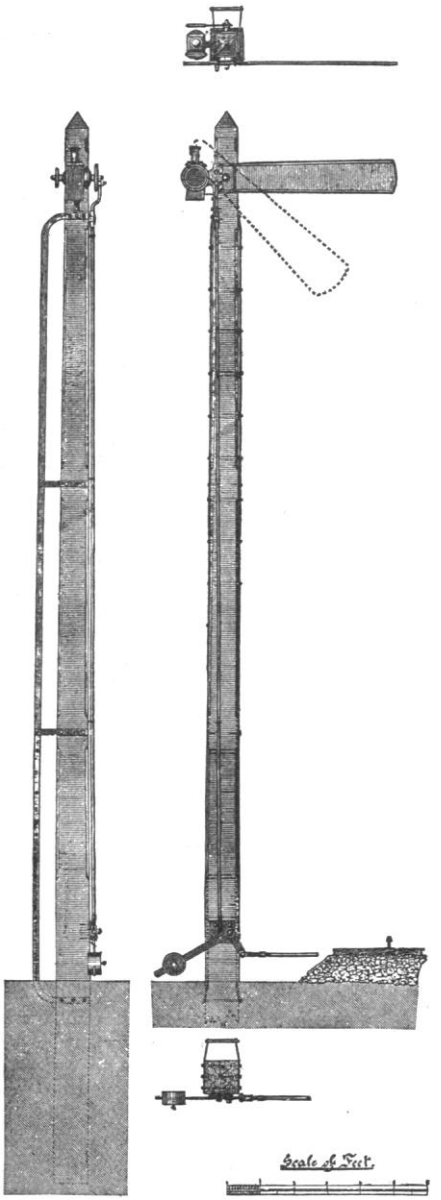
of color from red to white, without any change of form, conveys no information whatever in certain states of the weather and with certain backgrounds. Other signals are alike, back and front. Facing the train, they signify danger; standing edgewise, they mean safety: but unfortunately it is difficult to know whether they refer to an east-bound train or a west-bound train; and, though they may be placed on the right hand of the engineer to whom they refer, this arrangement is not always free from ambiguity.

The semaphore signals, as shown at the exposition, consist of vertical posts which have one or more arms pivoted at their upper ends; and these arms are capable of moving through a right angle in a vertical plane. An arm raised to a horizontal position signifies danger; inclined at an angle of about 45°, it signifies safety. A powerful lamp is fixed near the top of the post; and, when the arm stands horizontally, a disk of red glass stands in front of the lens of the lantern, which then, of course, shows a red light, indicating danger. When the arm drops to an angle of 45°, the red disk moves, and leaves the lantern unobscured, showing a white light, and indicating safety.

The semaphore arms are weighted, so that their normal position is horizontal, indicating danger; and the signalman has to overcome this weight in pulling them to safety. The object of this arrangement is, that the breakage of the connection between the lever in the signalman's cabin and the semaphore will release the signal, and let it fly to danger.

It is usual to place one signal at or as near as possible to both the signalman's cabin and the spot where the engine of an advancing train should stop if the signal is against the train. This signal is called the 'home' or 'main' signal. Another signal is placed some distance off in the direction from which the train comes: this is termed the 'distant' signal. The object of this arrangement is, that, on catching sight of the distant signal, the engineer is warned, and has some time and distance in which to stop his train before he reaches the home signal, beyond which the danger lies.

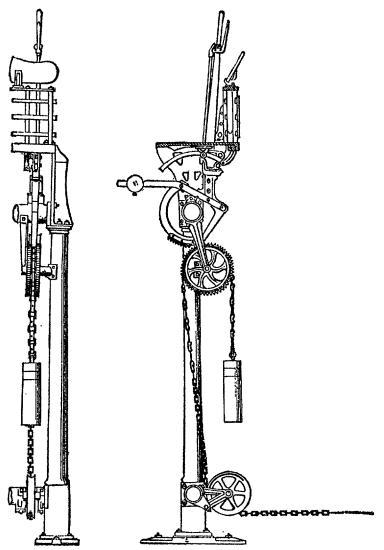
As the levers work switches and signals at a considerable distance, the connections between them have to be carefully made and protected from accidental injury and the effects of the weather, while the difference in length due to difference in temperature has to be compensated for; so that the signal is moved with certainty, though the wire or pipe connecting it to the lever vary in length several inches in the twenty-four hours, owing to the difference in temperature between the day and night. The Pennsylvania steel company exhibits an especially neat device for keeping the wire or connection to a distant signal always tight. The wire is kept stretched by an ingenious application of the pull of a weight, which acts only when the signal is in its normal position of danger to which it is weighted. When the signal is



SEMAPHORE.

pulled to safety, it is directly controlled by the signalman.

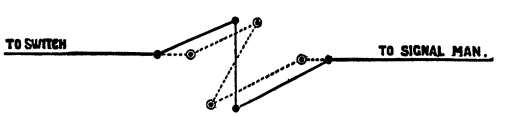
Connections to switches are generally made by means of rods or pipes jointed together,



DEVICE FOR KEEPING SIGNAL-WIRE TIGHT.

and running on rollers. A 'trunking' or wooden covering is then placed over them to protect them from snow and the feet of anyone walking about the yard.

As it is very important that the movement of switches should be absolute and exact under all conditions, — that is to say, that the switch be always either tightly closed or wide open, and never stand partly open, — a compensating arrangement is introduced half way between the switch and the signal, so that, whatever the variation of length of connection from temperature, the switch is unaffected, and its movements can always be under exact control.

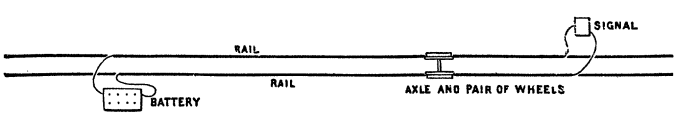


COMPENSATING JOINT FOR EXPANSION OF RODS.

The full lines show the position in cold weather; the dotted lines, in hot. It is evident, however much the rod expand, the distance between switch and signalman is unaltered, and therefore the movements of the switch and lever are unaffected.

In working railroads, some difficulty has always been experienced in keeping trains running in the same direction, on the same line of rails, from running into one another, as naturally, on a crowded line, an accidental stoppage to even a fast train may enable a slow train to overtake it and cause a rear collision. The Pennsylvania railroad adopted, some years ago, what is known as the block system, by which a definite interval of space (the distance between two adjoining signal-cabins) can always be maintained between two following trains. The system is too well known to need description here; but Mr. George Westinghouse has invented a system in which the same results are obtained, not by men signalling from one cabin to another, but by the trains themselves operating signals through the medium of electricity. The principle of the invention is easily understood, although the details are complicated and the results marvellous. A battery is connected to each signal by means of the rails, the current flowing to the signal by one rail, and returning by the other. The presence of an axle and pair of wheels on the track enables the current to flow through them, instead of through the signal apparatus. Directly the current is thus short circuited, the signal flies to danger.

This simple principle is so ingeniously worked out in detail, that a train approaching a road-crossing rings a bell fixed on a post at the



AUTOMATIC ELECTRIC BLOCK SYSTEM.

crossing until the crossing is reached, when the bell stops ringing; and this is done by trains travelling in either direction. In working on an ordinary piece of road, two signals behind the train are always kept at danger; and, on a single line, two signals in advance of the train are always kept at danger against a train advancing in the opposite direction. In a few words, the trains warn one another of their proximity.

We have dwelt on the subject of signals at considerable length, as the question is novel, and of great and growing importance; and we have no doubt that those who take an interest in railroads have found much to be gained by visiting the exposition, and studying this question on the spot. The two exhibits we have mentioned represent the best results attained in England after forty years' patient and careful study of signals, under such trying

conditions that the very existence of railways there depends upon the handling of enormously concentrated traffic with safety, certainty, and rapidity; and the results of these labors are probably not far from a perfect solution of the problem, and deserve our most careful study.

(*To be continued.*)

FIFTEENTH ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.[1] — II.

On Thursday the convention again assembled at St. Paul, at 11 A.M., and listened to a paper by J. P. Frizzell of St. Louis, upon the water-power at St. Anthony's Falls. The height of fall, watershed, rainfall, and horse-power utilized were given. He criticised the means taken for preserving the falls, the building of storage-dams at the head waters of the Mississippi, and the method of using the water at Minneapolis. He condemned the waste of power occasioned by a gross disregard of the laws of hydraulics, and pointed out the remedy. He stated that three things should be done, — the U. S. government must be induced to withdraw wholly, leaving the work of preservation of the falls to the owners of water-power; the two companies controlling the power must be united under one management; the natural width of channels at the falls must be restored.

Capt. O. E. Michaelis, U.S.A., followed with a short paper on metrological investigations, which he said were brought about by the attempt to determine how much a certain bullet was 'out of true.' He constructed and exhibited an instrument closely allied to the spherometer, to which he gave the name of 'tripod caliper.' He read results of measurements with this instrument, and applied it further to testing the accuracy of one turn of a screw-thread.

Mr. D. J. Whittemore, chief engineer of the Chicago, Milwaukee, and St. Paul railway, read a brief paper on the use of the Nasmyth steam-hammer for driving piles, and gave instances of the hindrance which a very slight 'brooming' of the pile-head offered to the effective action of the hammer. He also submitted a section from the top of a green Norway pine pile, where the friction of the fibres, under the rapid blows of the hammer, had generated sufficient heat to burn the heart of the head of the pile quite across.

Papers by Benjamin Reece, of Toledo, O., upon railway-track repairs, and by J. W. Putnam, upon cause of decay in timber, were read by title, and ordered printed in the proceedings.

[1] Concluded from No. 24.

In another room, before the persons most directly interested, a paper was read by F. P. Stearns of Boston, upon the current meter, giving a theory for the maximum velocity of water, flowing in an open channel, being found below the surface.

The society then held a business-meeting, in which a committee for nominating officers of the society was elected. Committees on uniform tests of cement and on the preservation of timber were granted further time. The committee appointed to procure aid from Congress to carry on the tests of iron and steel reported progress, and was continued.

The special committee on standard time made a report through Dr. Eggleston to the effect that they had obtained a general expression of opinion from men prominent as engineers, railway managers and operators, and others in all parts of the United States and Canada, and found that exceptional unanimity prevailed with respect to the fundamental principle which should govern in the adoption of a system of standard time for the whole country. The benefits of a change from the present lack of system were illustrated, and it was claimed that the time had arrived for action in the matter. The report was accepted, and the committee continued.

The convention at St. Paul then adjourned. The U. S. engineer officers on duty in this vicinity had an exhibit, in another room, of plans showing the various works of improvement under their charge.

On Friday, June 22, the convention met in Minneapolis. The party was carried from Hotel Lafayette across Lake Minnetonka by steamer, and thence by a narrow-gauge railway, in open cars, to the city. The meeting took place in the opera-house. A welcome was given by ex-Mayor Rand in behalf of the city; a reply and the annual address, in the absence of President Charles Paine, was read by Director William Metcalf, who took for his subject 'Engineering improvements in the Mississippi valley.'

Mr. William P. Shinn then read a paper upon the subject, 'How can railways be made more efficient in the transportation of freight?' which is a sequel to his paper of similar title read at the annual meeting in 1882, and aims to sum up the discussion, and more particularly to reply to the criticisms of Mr. O. Chanute thereon. He claims that facts and figures, which he adduces, prove that the present mileage basis for the adjustment of car accounts between different railroad companies is unjust to the companies furnishing the cars; that it is

costly and discouraging to prompt shippers; that it leads to slow movement of loaded cars and to non-movement of empty cars; that it is not practised in other countries, nor does any like practice obtain in any other business in this country. The *per-diem* basis, on the contrary, is perfectly practicable, as proved by two years' trial on the Union Pacific, and Chicago, Burlington, and Quincy railroads, and its use in a modified form in two European countries.

At noon the convention adjourned. The rest of the day, and Saturday, were given up to the very pleasant excursions and entertainments furnished by the people of the vicinity.

If one-half as much is done to render the coming meeting of the American association pleasant, those who attend will find themselves well entertained.

SOME GEYSER COMPARISONS.

HAYDEN'S twelfth annual report, published by the U. S. interior department, has been in the printer's hands for some time, and will doubtless be shortly issued from the government printing-office. Part ii. of this report relates to the Yellowstone national park, and in it the hot-springs are fully described, and the geology and topography of the park treated of in detail.

It is proposed here to point out briefly some of the differences in relation to geysers between the results of the work in the park and those reached by Bunsen in his study of the Iceland field. It is not necessary to present Bunsen's conclusions in detail, nor to describe his theory, with which doubtless the majority of the readers of SCIENCE are familiar.

Bunsen's conclusions, as presented here, are mainly the same as stated by LeConte in his Elements of geology, although not considered in the same order.

1. Bunsen found in Iceland two kinds of springs, viz., *acid springs* and *alkaline carbonate springs;* and he says that only *alkaline carbonate springs* become siliceous, and that only silicated springs form geysers.

2. The silica in solution does not deposit on cooling, but only by drying.

Our observations in the Yellowstone national park in the main verify this last conclusion, and it is inserted, because LeConte takes exception to it as follows: "This, however, is not true; for the Yellowstone geyser-waters, which[1] deposit abundantly by *cooling*, evidently because they contain much more silica than those of Iceland."

[1] This is evidently a grammatical error.

The following table gives the results of the observations in the park as far as they have been made in regard to the points just enumerated.

Name.	Character of spring.	Grains of silica to imperial gallon.	Reaction of water.	Condition of water after three years, when bottles were opened.
Jug . .	Quiet spr'g,	14.56	Alkaline,	Perfectly clear, no deposit.
Echinus .	Geyser . .	10.60	Acid . .	Perfectly clear, no deposit.
Pearl . .	Geyser . .	7.84	Alkaline,	Clear, with small deposit of gelatinous silica.
Opal . .	Quiet spr'g,	53.76	Alkaline,	Opaline as when bottled, no deposit in bottle.

Here, then, we have an alkaline spring and an acid spring, both of which are geysers. We see, also, that the mere fact of cooling has little to do with the throwing down of the silica, nor does the precipitation appear to be due to the amount of silica held in the water. Ordinarily the formation of siliceous sinter or geyserite must be explained by the evaporation or drying of the water as it flows from the springs, or falls from the geysers.

The chimney-like form is very noticeable in the craters of the Yellowstone geysers; and LeConte attributes it to the greater abundance of silica in solution in the waters of the Yellowstone geysers.[1]

As a fact, however, the analyses already made of geyser-waters from the park show usually a smaller percentage of silica than do those of Iceland. Opal spring (see table above) is an exception, and it is a spring without the least appearance of a crater or chimney. The real explanation is probably in the greater age of our geyser region.

3. Bunsen's conclusions as to temperature are as follows: —

a. The temperature increases with the depth of the tube.

b. At no point in the tube does the water have the temperature of ebullition which it should have under the pressure to which it is subjected.

c. The temperature depends on the time that has elapsed since the last eruption; and, as a great eruption approaches, the nearer it comes to the boiling-point.

d. At a depth of forty-five feet in the Great geyser, the difference between the observed temperature and the calculated boiling-point of the water for that depth and pressure was the least.

[1] Elements of geology, p. 104.

In the Yellowstone national park, wherever deep temperatures were taken in active springs and geysers, they were found to increase with the depth; but temperatures of ebullition were found at the surface of many springs, and in some the temperatures exceeded the boiling-point. As the time for an eruption in a geyser approached, the temperature increased, which fact agrees with Bunsen's observations.

In 1865 a Mr. Bryson of Edinburgh found that the tube of the Great geyser of Iceland has a ledge about forty-five feet below the top of the tube, and that, from beneath this ledge, steam-bubbles rose while the tube was filling. A thermometer sunk to this point was violently dashed about and broken, but, when sunk below it, was quiet and undisturbed. The conclusion is, that here is an opening by which steam and superheated water have access to the main geyser-tube from the side. Similar side-openings are known to exist in Strokhr; but the Great geyser is so full of water that its structure cannot be so readily studied as in the case of the smaller Strokhr. In Bunsen's theory this point forty-five feet below the surface plays an important part. He allowed his thermometer to remain at the bottom of the geyser-tube during a great eruption, and it was undisturbed. Mr. Bryson's discovery explains its safety. It was below the active side-vent of the geyser.

Bunsen's conclusion would therefore probably have to be modified so far as relates to the temperature of ebullition not being reached; for, could he have obtained temperatures in the side-conduit, there is but little doubt that the boiling-point would soon have been reached, even for the pressure of that depth. The mass of water in the main tubes prevents that condition at the surface; and, when it is attained opposite the aperture, an eruption occurs.

Bunsen's theory of the formation of geyser-tubes also requires some modification. Contrary to his opinion, the deposit of silica is not necessary for geyseric action. In the Gibbon geyser basin in the national park are several geysers conspicuous from the small amount of siliceous deposit surrounding them; and one in 1878 was entirely without a deposit, having just broken out as a steam-vent. By the following year it had settled down to regular geyser action.

As already mentioned, there are, in the park, geysers the water of which is acid in reaction; and therefore the theory that before developing into a geyser the spring must pass through a preliminary tranquil or non-eruptive stage (in which it is an acid spring) is not warranted by the facts observed in the Yellowstone region. It is probable that all geysers are originally due to a violent outbreak of steam and water, and that the first stage is that of a huge steam-vent. Under such conditions, irregular cavities and passages are more likely to be formed than regular tubes. The lining of the passages and tubes takes place afterwards, and is a slow process. Whether the subterranean passages in which the water is heated are narrow channels, enlargements of tubes, or caverns and tubes, is probably of little consequence, except as the periods or intervals of the geyser are influenced. If water in a glass tube be heated rapidly from the bottom, it will be violently expelled from the tube, or, if boiled in a kettle that has a lid and a spout, either the lid will be blown off, or the water will be forced out of the spout. In the first case we have an explanation, in part at least, of Bunsen's theory; and the second exemplifies the theories which presuppose the existence of subterranean cavities and connected tubes. The simpler the form of the geyser-tube, the less is the impediment to the circulation of the superheated water; and in this fact lies the explanation of the difference between constantly boiling springs and geysers. The variations and modifications of the subterranean water-passages, however, must be important factors entering into any complete explanation of geyseric action.

Bunsen's theory, somewhat modified, is probably the best yet proposed, especially that part of it which explains the effect of the rise of water nearly at the boiling-point to an upper portion of the channel where its temperature is in excess of that necessary to cause ebullition. The excess of heat is violently and instantaneously applied to the production of steam. McKenzie, in 1810, also recognized the fact that the sudden evolution of steam was the proximate cause of the eruptions; but he could not account for their periodical production.

The water of geysers and hot-springs has been boiled and reboiled for an inconceivable period, and is freed from air as no other water is. Its cohesion is therefore immensely increased; and this fact, together with the obstruction to the free escape of steam caused by irregularities in the channels, offers a complete explanation of the superheating of the water; and it is well known, that, when water so heated does boil, the production of vapor is instantaneous.

A. C. Peale.

THE AFFINITIES OF RICHTHOFENIA.

DR. W. WAAGEN considers the results of his recent study of the new genus Richthofenia Kays. (Anomia Lawrenciana Koninck) so remarkable as to deserve a preliminary notice (*Rec. geol. surv. India*, xvi. 1). Mr. Barrande and Professors Valérin and Möller were of opinion that this fossil was more nearly related to the corals than to any other class of animals, while Professors Zittel and Lindström seemed to be in favor of the view that it was a brachiopod. In favor of the latter view, the microscopic structure of the shell is the most important point. Its silky lustre is identical with that of Productus, though this seems to be effected by different means. In the shell of Productus it is caused by obliquely ascending prisms, whilst in Richthofenia it depends apparently on the fine lamination of the shell, as in Placuna or similar genera. Of great importance is the prismatic structure of the single laminae of which the shell of Richthofenia is composed. Such a prismatic structure is chiefly characteristic of mollusks and molluscoids. Dr. Waagen has never yet observed this structure in corals. In Calceola sandalina, which seems the most kindred form among corals, a microscopic section through the larger valve showed well its radial septa ; but all these septa exhibited a granular, not a prismatic structure. The punctation of the shell is very similar to that of Productus, and so are the hollow root-like tubes which penetrate the shell-substance of the larger valve, and adhere to other bodies. The smaller valve can also be very well compared to the same valve of Productus, although it is doubtful whether the thick parallel ridges on the hinge-line of this valve of Richthofenia can at all be compared to a cardinal process, and whether the impressions on the valve can be taken as muscular impressions. Reniform bodies are most certainly absent. Nevertheless, among the brachiopods, the Productides are the only ones to which the genus Richthofenia might stand in any relation.

Richthofenia possesses certain points of resemblance with rugose corals, — the irregular partitions in the lower part of the larger valve ; the columella-like portion, which is divided off by three vertical septa ; these septa themselves, which can well be compared to the primary and the two lateral septa of a rugose coral ; the cellular structure of the shell ; the septa-like ridges on the outer wall of the animal chambers, which are in connection with the hollow canals which pierce the substance of the shell ; and the tortuous tubes themselves, into which the canals are prolonged on the outer side of the larger valve. There can be no doubt, that on first inspection, ignoring the silky lustre of the shell, one would be far more likely to regard this fossil as a coral than as a brachiopod.

The points of similarity between Richthofenia and the Rudista, chiefly Hippurites, are not very numerous. If we make a section of Richthofenia from the hinge-line to the opposite wall, so as just to touch the median vertical septum, we obtain a figure very similar to what a Hippurites shows when cut so as to touch the first columellar fold. Another point of similarity consists in the direction of the prisms, of which the substance of the shell is composed. The Rudista differ from all the other groups of Pelecypoda in having the prisms of the outer shell arranged vertically ; i.e., longitudinally to the whole extension of the shell. The same is the case in the median shell-layer of Richthofenia. A third point of great importance exists in the pallial impression which is common to Richthofenia and the Rudista ; and, finally, it is not quite certain that the sinuations of the large valve of Richthofenia on both sides of the hinge-line, which stand in so close a connection to the lateral vertical septa, may not be regarded as the beginning of the infoldings of the shell, so characteristic of the Rudista. The distance in time between Richthofenia, which comes probably from the limits between the carboniferous and Permian formations, and the Rudista, which are for the most part upper cretaceous, is so enormous, and the absence of every connecting-link so complete, that a close affinity between the paleozoic and the cretaceous forms should not be expected. It will therefore only be possible to prove the connection between the present fossil and the Rudista, when further members of such a developmental series are discovered.

As the case now stands, it will be most prudent, in accordance with the microscopic structure of the shell, to consider the fossil as something like a brachiopod. As far as Dr. Waagen's opinion goes, he is convinced that Richthofenia is a member of a series, which, branching off somewhere from the rugose corals, has reached in Richthofenia a brachiopod-like stage, and is going to terminate its career as a Pelecypod, as one of the Rudista. But opinion is nothing in science, and proofs are every thing. As yet, it cannot be positively denied that Richthofenia may be a predecessor of the Rudista.

J. B. MARCOU.

THE GREENWICH OBSERVATORY.

AMONG the leading points referred to in the report of the astronomer royal, W. H. M. Christie, F.R.S., to the board of visitors of the Royal observatory, Greenwich, read at the annual visitation on June 2, are the following: —

Besides the regular subjects of observation with the transit-circle, — the sun, moon, planets, and fundamental stars, — a new working-list of 2,600 stars, comprising all those down to the sixth magnitude inclusive, and not observed since 1860, has been prepared, and was brought into use at the beginning of March. The entire number of transits observed with this instrument during the year was 4,488; determinations of collimation-error, 354; determinations of level-error, 323; number of circle-observations, 4,485; determinations of nadir-point, 298; reflection-observations of stars, 484. Comet *a* 1882 was observed seven times on the meridian, and comet *b* 1882, three. The routine reductions of all the observations with this instrument are reported in an extraordinary state of forwardness. From the beginning of this year, a correction of $-0''.39$ has been applied to the

results of the nadir-observations to make them agree in the mean with the results of the reflection-observations of stars. This discordance was insignificant in 1878, and is on the increase: its source has not yet been traced. Three determinations of flexure have been made during the year. The correction for $R-D$, the error of assumed co-latitude, and the position of the ecliptic, have been investigated for 1882. The value for the co-latitude, from the observations of 1882, is 38° 31′ 21″.93. The correction to the tabular obliquity of the ecliptic is + 0″.44. The mean error of the tabular right ascension of the moon, from observations with the transit-circle, is + 0ˢ.82.

The observations of the moon with the altazimuth have been restricted to the semi-lunation between last quarter and first quarter; and some limitations have been adopted in the computations which render the reduction of observations with this instrument comparatively light. The moon's diameter has been measured thirty-three times, counting measures in both co-ordinates with the transit-circle and the altazimuth.

A very valuable addition has been made to the instruments of the Royal observatory by the gift of the Lassell two-feet reflecting equatorial, generously presented by the Misses Lassell. This is the instrument with which the Saturnian satellite Hyperion was discovered in 1848. It was removed from Maidenhead early in March, and has been suitably mounted in the grounds of the Royal observatory. The telescope has two large mirrors available for use; and the astronomer royal contemplates attaching one of them to the tube of the 'south-east equatorial,' which has a firm mounting and a perfect clock-work, and employing it for spectroscopic and photographic work. The Lassell telescope itself is well suited for the observation of faint satellites and comets which are beyond the present instrumental means of the observatory.

The observations of the solar eclipse of 1882, May 17, with the south-east equatorial, have been completely reduced, and the final equations solved.

Spectroscopic observations during twelve months have been somewhat restricted through the pressure of photographic reductions at the time of a maximum of sun-spot frequency. The solar prominences were observed on eight days, and four sun-spots were examined on eight days with reference to broadening of lines in their spectra. The spectrum of the great spot of 1882, Nov. 12–25, showed some remarkable reversals of the lines of hydrogen and sodium, and extraordinary displacement of the F line.

As regards determinations of motion of stars in the line of sight, a hundred and forty-two measures have been made of the displacement of the F line in the spectra of twenty-three stars, and twenty-six measures of the line b_1 in nine stars. The observations of Sirius during the past winter tend, on the whole, to confirm the impression that the rate of recession of this star had diminished progressively since 1877, and that its motion is now on the point of being converted into one of approach.

The spectrum of comet *a* 1882 was examined on three nights; that of the great comet *b* 1882, also on three nights; and that of comet *a* 1883, on one night. The spectrum of the first-named object showed the yellow sodium-lines with great brilliancy just before perihelion passage. The spectrum of the aurora was also examined in 1882, Nov. 17. The spectroscopic observations of all kinds are completely reduced to 1883, May 20.

During the year ending at this time, photographs of the sun were taken on two hundred days, and three hundred and thirty-nine plates have been selected for preservation. The sun's disk was free from spots on seven days; and, since the extraordinary outburst of last November, the sun has been comparatively quiescent. The astronomer royal proposes soon to employ a modified photoheliograph for this work, so as to obtain photographs of the sun eight inches in diameter instead of four. The measurement of a large number of Indian and other photographs of the sun, required to fill gaps in the Greenwich series, has been completed, these photographs having been received from the Solar physics committee.

The course of the magnetic observations has remained the same as in former years. Improvements have been made in the methods of photographic registration. There has been considerable magnetic activity during the year. The disturbances of November last are to be detailed graphically in the 'Greenwich magnetic results for 1882.' Particulars of magnetic disturbances are regularly communicated to the *Colliery guardian* newspaper, for the information of mining surveyors.

The mean temperature of 1882 was 49°.6, or 0°.1 lower than the average. The highest air-temperature was 81°.0, on Aug. 6; and the lowest, 22°.2, on Dec. 11. The mean monthly temperature was above the average from January to May, then below until September, and differed little from the average during the remainder of the year. The mean daily motion of the air was 306 miles, 27 miles greater than the average. The greatest daily motion was 758 miles, on Nov. 4; and the least, 30 miles, on Dec. 11. The greatest hourly velocity was 64 miles, Oct. 24. The number of hours of bright sunshine, as recorded by Campbell's sunshine instrument, was 1,245; that is, 40 hours above the average of the five preceding years. The rainfall of 1882 was 25.2 inches, slightly above the average.

In conclusion, the restriction in the observations of the moon with the altazimuth enables more attention to be given to observations with the equatorials. Two observers are now available for spectroscopic observations during the coming year. Mr. Christie characterizes the past year as, in some slight degree, one of transition, and preparation for future work. Some administrative changes have been made; but the regular course of observation and reduction has not been disturbed, and the standard meridian observations have been maintained in full vigor.

LETTERS TO THE EDITOR.

Impregnation in the turkey.

WHEN I was a boy, my father used to send me to some of the neighbors with our turkey-hen, and we left her there with the cock a day or so. Either this, or we would borrow a cock for a day or so, and turn him with our hen. This was not only for one year, but our custom; as we never wintered a turkey-cock, and we did raise turkeys by this process. There was no possibility of the turkey-cock getting with our hen after the contact mentioned above. I did not know that this fact was still unknown to people. What is still a question that I should like settled by experiment is, whether the spermatozoids are retained somewhere in the oviduct until the eggs reach a certain stage of development, or whether they at once impregnate the eggs. W. MANN.

Potsdam, N.Y., July 5.

[We give place to the foregoing extract from Mr. Mann's letter, referring to Mr. Shepard's communication in No. 20, p. 576, on the same subject. There are probably many species of birds in which one connection with the male suffices to impregnate a whole batch of eggs. That the turkey, like the common hen, is one of these, is a fact which hardly requires further confirmation. There can be little question that the spermatozoids are retained in the oviduct, as in other animals, and the eggs impregnated as they successively mature.]

Macloskie's Elementary botany.

The review with which you favor my Elementary botany catechises me as to whether I am sure that the seeds of Lepidium emit mucilaginous threads. Permit me to answer that I am sure, having made the experiment a dozen times. Violets, besides the orders cited by the reviewer, prove that the statement as to cymose flowers being actinomorphic requires modification. I sympathize with the objection to the terms 'exotest' and 'endotest;' but the terms 'primine' and 'secundine' are bewildering to authors as well as students, and give priority to the part which is in most cases a result of secondary differentiation; 'tegmen' is obsolete, and the whole subject of the development and structure of the seed-wall requires revision: hence the provisional use of terms which, though hybrid, are easily understood, and not likely to mislead the young. G. MACLOSKIE.

July 10, 1883.

[We conjecture that Professor Macloskie had mixed in his mind, or at least in his statement, two different cases, — one, that in which the wall of the surface-cells of the seed-coat, changed into a substance which swells into mucilage upon wetting, contains a spiral thread, as in Collomia; the other, in which there is no contained thread. According to our observations, the seeds of Lepidium belong to the latter: hence the 'catechism,' which was intended to call attention to a possible oversight. We have to-day verified our observation upon seeds of Lepidium ruderale. Perhaps Professor Macloskie will kindly indicate the species in which he found the threads. — REVIEWER.]

Primitive streak of vertebrates.

Dr. Strahl of Marburg has had the kindness to write to me concerning the abstract of his researches (SCIENCE, i. **521**). A part of his letter contains an explanation which I shall be glad to have published in justice to Dr. Strahl. Translated, the passage is as follows: —

"As regards the esteemed remark at the close of the abstract, — that I have declared erroneous Balfour's comparison between the primitive streak and neurenteric canal on one side, and the blastopore of Amphia and fishes on the other, — the remark may be due to a misunderstanding. So far as known to me from his descriptions, Balfour placed the neurenteric canal at the anterior end of the primitve streak. But, as I have shown in my paper, the neurenteric canal originally lies in the middle of the primitive streak. The object of my demonstration is to show that the premises from which Balfour starts do not agree with the observations: this, I believe, was accomplished. This would also decide the second point made by you, — that my argumentation against Balfour was defective."

I am much indebted to Dr. Strahl for his letter, and I think others will value his short statement of his position. CHARLES SEDGWICK MINOT.

In an Indian grave.

In an Indian grave in Santa Barbara county, Cal., the writer found a beautiful specimen of doubly terminated limpid quartz, with a cavity half an inch long containing water or some other fluid. It was about four feet below the surface, and had been carefully deposited with many other stone implements, and was doubtless highly prized by its aboriginal owner. STEPHEN BOWERS.

WARD'S DYNAMIC SOCIOLOGY.

II.

IT is proposed to show the relation of Mr. Ward's publication to current thought.

The law is composed of the rules of conduct which organized society endeavors to enforce. The law, therefore, represents the quantity and quality of regulation, or, in other words, of government, which the people of the state in their corporate capacity deem necessary for their welfare. With respect to the amount and kind of government (i.e., of regulation, i.e., of law) which the best interests of society require, there is a very wide divergence of opinion between the chief publicists of civilized nations and the people themselves as they are represented by law-making bodies. The publicists tell us we are governed too much; but the people are demanding more government, and, in obedience to this demand, law-making bodies are rapidly extending the scope of law. The careful observer of the progress of government, who is at the same time a careful reader of opinion presented in the larger body of works on state craft, in the more carefully prepared dissertations on this subject appearing in the great reviews, and in many of the best editorials of the daily press, is astonished at the extreme conflict between opinion and practice.

There are two classes of law-making bodies, — courts and legislatures. The growth of law through the courts is almost unrecognized by the people at large; yet its development

by this agency is perhaps more rapid than by legislation. The legal principles enunciated in the decisions of a system of courts such as we have under the general government and in the several states are rapidly developing to meet the demands of the vigorous growth of civilization. Some months ago the public prints announced a decision of the supreme court of California which well illustrates this statement. In more than two-fifths of the area of the United States all agriculture is dependent upon artificial irrigation. In 1866 the Congress of the United States, in order to promote mining industries in this region, and incidentally to promote agriculture, enacted a statute giving to individuals and corporations the right to take the water of the running streams of that country from the natural channels in which they run, and use the same for mining and agricultural purposes. Now, the nature of this use is such that the water itself cannot be returned to the natural channels to be used again; and by this law the antecedent common law relating to riparian rights was repealed. As the agricultural interests of the country were developed, it was soon discovered that all agricultural operations were under the control of water companies; for these companies claimed ownership to the water, and the right to use it themselves or to sell it to whom they pleased. But the decision mentioned above was to the effect that these companies possess only the water-ways, the canals and hydraulic appliances connected therewith; that they are common carriers of water, and are themselves subject to the law relating to common carriers. By reflection it will be perceived that this decision will affect vast interests, and deeply influence the daily life of thousands, and eventually of millions, of people. This serves to illustrate the nature of the court-made law, which is so rapidly growing, and affecting in a multitude of ways the relations of men, and restricting the rights of the few for the benefit of the many, which is in the very nature of law. In the above statement it will be observed that the initial change in the law was the statute of 1866. So the national and state legislatures are constantly engaged in making new laws for the government of the people; and this, in the main, ever in obedience to popular demand.

Such is the practice. The legislature stimulates the court, and legal decisions incite new legislation; and thus it is that the public men of this country and of other civilized nations devote their energies to the development of government by devising new laws for the regulation of conduct, and creating new offices for the administration of law.

Again: in every community there is a body of good and earnest people demanding reform, or devising methods for the improvement of mankind in diverse ways, — for the relief of the unfortunate, for the education of the masses, to diminish suffering, crime, and ignorance; and the energies of these people, exerted everywhere, in season and out of season, create a sentiment that law-making bodies cannot ignore.

Yet, in opposition to all this, the publicists ask for less government, and say, 'Let society alone.' This theoretic opposition to the course of progress, manifest in the development of institutions, arises from the standpoint, or phase of the philosophy of evolution, at which our thinkers have arrived. The laws of biologic evolution are applied to sociology. The philosophy of science, which is but inchoate, is adjudged to be complete, and principles that require restriction are held to be universal.

In biologic evolution the cause of progress is recognized as the survival of the fittest in the struggle for existence; and this has been widely accepted as the cause of sociologic progress, and Herbert Spencer is the prophet of this philosophy. As set forth by him and his large following, progress is secured by an inexorable law of nature, which brooks no interference; and the efforts of mankind to improve the condition of mankind do but retard the natural process; and the proper sphere of government is the direct suppression and punishment of crime, and that only. It is from this postulate that the theorists are antagonizing the practice of all the legislatures and courts of civilization. Though Mr. Ward does not state the problem as above, yet his book is written to controvert the Spencerian and generally accepted theory, to present a new philosophy of society which shall be sufficient warrant for the course pursued by practical statesmen and jurists, and to support the earnest people of the world in their efforts to benefit the race. His postulate, though stated in other terms, is essentially this: that social progress is due to the struggle for happiness, and the adoption of that conduct which secures happiness; and that the process, instead of being natural and genetic, is artificial and teleologic; that men devise methods for securing happiness, and gradually attain their ends.

Mr. Spencer looks upon society as an organism, and in this he is followed by Mr.

Ward; but the former author makes it the central point of his sociology, around which all other facts are gathered, and he elaborates a system of analogies with biologic organization, as if, in fact, they were homologies. It will perhaps be nearer the truth to speak of a state, rather than society at large, as an organism.

The organization of mankind is twofold, — activital and regulative. By the activital organization, which is usually discussed in works on political economy under the title 'division of labor,' the industries and other occupations of mankind are parcelled out to individuals and corporations; so that a man, in working for himself, works for many others, and an interdependence of parts in the social organism is thus established. For the successful operation of the activital organization, the regulative organization is established, which results in govermnent, with its three co-ordinate departments, — executive, legislative, and judicial. Without division of labor and governmental regulation, the individuals of the human race would be entirely discrete; with them, mankind is organized into societies which we call 'states.' In so far as the people of one state are related to the people of another through their industries, there is an inchoate organization of state with state, which can only be completed by the consolidation of such states. Though Mr. Spencer devotes an inordinate space to the demonstration of the organization of society, he fails to discover, that, in so far as organization is accomplished, the method of biologic progress by the survival of the fittest is repealed. In the struggle for existence, state comes into competition with state; and to this extent the biologic law of the survival of the fittest applies. But in the relations of the interdependent parts of states, i.e., the different classes of people existing in a tribe or nation, the law of the survival of the fittest in the struggle for existence no longer applies; the unfit do not succumb; the welfare of each class (i.e., each organ, interdependent part) depends upon the welfare of each other part, — of the whole. There may be a competition for leadership, or for eminence in other respects, but not for existence.

Those who adopt the Spencerian theory believe that they find confirmation of their doctrine in the history of legislation. In modern times, since the differentiation of executive, legislative, and judicial organs and functions in government, legislation has often been unwise, and laws have failed to secure the purposes for which they were enacted. In this branch of human endeavor it would be strange if it were everywhere and at all times characterized by wisdom, when man has so frequently failed in other effort.

But beside the general failure for lack of wisdom, there has been failure for certain special reasons. Early law was common law; later law is in part statutory. In the change from the former to the latter, many great mistakes have been made. The body of law existing in a state, be it tribal or national, is the chief body of the ethics of the people of such state. But among such people there are ethical rules not found in the law, but held by individuals in a greater or less number. These non-legalized ethics are of two kinds, — first, those which have passed from the law, and are yet held in veneration by a part of the people; second, those which the more advanced minds are endeavoring to establish. The first are obsolete; the second, inchoate. Much of the law which Spencerian philosophers have used to illustrate the folly of legislation has been in instances where an attempt has been made to revive obsolete common-law principles by effective statutory law. Mr. Spencer's illustrations are chiefly of this class; and he has been followed by many a writer. This source of disaster can be avoided, not by refusing to legislate, but by a proper knowledge of the course of progress in social evolution. This course of evolution has not been, as Mr. Spencer postulates and elaborately discusses, from more regulation to less, from militancy to industrialism, but from less to more law, and from non-essential to essential regulation. When diseases were believed to be the work of evil spirits, or to result from the practice of sorcery, the relations of men to supposed spiritual beings were regulated, and witchcraft was punished; but, when diseases are discovered to be due to unwholesome conditions of environment, sanitary laws are enacted. And in like manner in every department of government the change is going on. Laws are sociologic inventions, analogous to the technologic inventions of the industries. Along with much failure there is much success. As the progress of industries would cease were no new methods devised, so the progress of society would end if new law were not enacted.

Dynamic sociology, as presented by the author, is the philosophy of human endeavor, and the justification of man in his effort to to improve his condition. Those persons, and they are many, who are actively engaged in the promotion of institutions and regulations for the benefit of mankind, will find in it philosophic hope; while those who are opposed

to the course of practical events appearing in public affairs cannot afford to ignore their strongest opponent.

The evolution which is discovered everywhere in nature, to be properly demonstrated, must have its explanation set forth in three parts. First, it must be explained why there is change, for without change there can be no development; second, it must be shown by what agency change results in progress, for change to inferior or co-ordinate conditions is not evolution; and, third, what is the course of progress, for, if there is progress, it must be in some direction that can be determined, and thus science becomes prophetic.

Of the three departments of sociology, — namely, the causes of social change, the causes of social progress, and the course of social progress, — the work under consideration, as its name indicates, is devoted to but one, — the cause of social progress; though it incidentally discusses many of the subjects of evolution in other branches of science, and the author ultimately reaches the conclusion that education is the chief means to secure social progress, and thus secure human happiness.

SIEMENS' SOLAR ENERGY.

On the conservation of solar energy: a collection of papers and discussions. By C. WILLIAMS SIEMENS, F.R.S., D.C.L. London, *Macmillan & Co.*, 1883. 20+111 p. 8°.

THIS is a collection of the original paper read before the Royal society by Siemens, and the criticisms from Fitzgerald, Faye, Hirn, Archibald, and others, together with the replies of Siemens.

The theory, well summed up on p. 22, supposes that space is filled with aqueous vapor and carbon compounds; that these, at low pressures, are dissociated by the radiant energy of the sun; that the dissociated elements are drawn into the sun at its poles, unite, and generate heat sufficient to give a temperature of about 2,800° C.; and that the aqueous vapor and carbon compounds formed are again thrown off by centrifugal force at the sun's equator.

As evidence of the presence of carbon vapors in space, Siemens refers to the analyses of meteors, which in some cases have proved that hydrocarbons were a component of the meteoric mass, and again to the work of Abney and Langley on the absorption of the radiant energy of the sun.

The dissociation of vapors at low tensions is a point which seems to be well established. One of the earliest proofs is given in Prof. J. Willard Gibbs's paper on the equilibrium of heterogeneous substances.[1] He shows, that in a mixture of gases, as of oxygen, hydrogen, and vapor of water, in which the vapor is formed with a decrease in volume from that of the components, it is possible to assign a value to the tension such that the mixture may be in a state of dissipated energy; i.e., in such a condition that the energy of the system is a minimum for its entropy; and that any change in energy can be brought about only by work done by some outside system and in proportion to that outside work. In such a state, nothing of the nature of an explosion could be caused by an electric spark: the elements would cease to show the phenomenon of chemical affinity. Willard Gibbs writes, "It may, indeed, be true, that at ordinary temperatures, except when the quantity either of hydrogen or of oxygen is very small compared with the quantity of water, the state of dissipated energy is one of such extreme rarefaction as to lie entirely beyond our power of experimental verification." In the formula from which these results are deduced, the ratio occurs of the amounts of the components to that of the compound, these amounts being raised to small powers. This explains the qualification as to the amount of components which may exist in a free state.

This last condition may have an important bearing on the possibility of the truth of Siemens' theory; for, although Gibbs has shown that dissociation may occur in rarefied vapors, still the amount of the dissociation is limited unless the rarefaction be very great.

Some two or three years ago Professor Ogden Rood succeeded in getting experimental evidence of dissociation in rarefied gases at ordinary temperatures, but has never published his results.

Dr. Siemens gives, on p. 13, what evidence he early obtained of dissociation of gases in vacuum tubes under the influence of sunlight. What he has done since may be found from an account of his recent lecture at the Royal institution (*Nature*, May 3). Objections to the theory are well put by Fitzgerald when he asks (p. 41) "how the interplanetary gases near the sun acquire a sufficient radial velocity to prevent their becoming a dense atmosphere round him; why enormous atmospheres have not long ago become attached to the planets, notably to the moon; why the earth has not long ago been deluged when a constant stream of aqueous

[1] Proc. Conn. acad. sc., iii.

vapor, that would produce a rain of more than thirty inches per annum all over the earth, must annually pass out past the earth in order to supply fuel to be dissociated by the heat that annually passes the earth; and why we can see the stars, although most of the solar radiations are absorbed within some reasonable distance of the sun."

It can be hardly looked on as a strong answer to the first question, that "the gases, being for the most part hydrogen and hydrogen compounds, have a low specific gravity as compared with the denser gases forming the permanent solar atmosphere. On flashing into flame in the photosphere, their specific gravity would be vastly diminished, thus giving rise to a certain rebound action, which, coupled with their acquired onward motion and with the centrifugal impulse they receive by frictional contact with the lower atmosphere, constitutes them a surface-stream flowing from the polar to the equatorial regions, and thence into space." It is certainly hard to understand why the atmosphere of any member of the solar system should not be made up of the gases of interplanetary space in the same proportions in which they may exist in such space, if there is the free circulation called for by Siemens' theory.

Faye objects that the presence of such a resisting medium in space as the vapors is not to be accepted, with our present knowledge, and that the centrifugal force at the sun's equator is far too small for the action required.

Hirn, starting with the supposition that the sun's temperature is 20,000° C., writes, that, although the dissociated gases might unite in the chromosphere, they would, on passing down through the sun's atmosphere, be again dissociated, and absorb as much heat as they had given out on combining. To this, Siemens might have answered that the gases would again combine on passing off at the equator.

The discussion of the theory at the time of its first statement was most earnest; but, in spite of the ingenuity displayed in its elaboration, it as yet cannot be accepted as probable.

INSPIRED SCIENCE.

Eureka; or, The golden door ajar, the mysteries of the world mysteriously revealed. By ASA T. GREEN. Cincinnati, *Collins*, 1883. 141 p., portr., cuts. 16°.

THE publisher acts as editor of this book, interspersing his own chapters among the author's in an odd fashion. The florid periods of the one form a curious setting for the rough, ungrammatical language of the other.

The author has 'revelations' of a 'wonderful knowledge' which he obtained, partly in the woods, and partly in Oil City, and desires to impart them to scientific men. We will offer them a bit.

"If we would lay a telegraph-wire down down (*sic*) from every point of the earth, and of water, and all points telegraph at one time to a given point, the result would be to find that the atmosphere was going as fast as the earth, and the earth as fast as the atmosphere. *Thus you see* it is the atmosphere that carries the earth around. . . .

"Third reason why the earth is round; namely, because the mountains are up. If the earth was flat, the mountains would be just as liable to be down as up, but as the curvature of the earth is up, hence the mountains are up. . . .

"If sound travels by vibration, as science teaches, and science teaches that vibration creates heat, that if a cricket should stand on one end of a solid slab-stone and rub his wings together, why is it that the vibration with the particles of stone does not completely melt the stone in ten minutes? I deny the hypothesis."

'Wonderful knowledge,' indeed!

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Points of inflection. — Let $U = x^{\alpha}y^{\beta}z^{\gamma} + ku^{\delta} = 0$ be an equation in homogeneous co-ordinates; x, y, z, are the sides of the triangle of reference, and $u = ax + by + cz$; a, β, γ, δ, are integers such that $\alpha + \beta + \gamma = \delta$; a, b, c, are given quantities, and k a variable parameter. For $\alpha = \beta = \gamma = 1$, this equation gives a system of cubics having, as is well known, their points of inflection distributed by threes upon three right lines; viz., the three real points of inflection upon u, and the remaining six points, in threes, upon two imaginary lines.

The author, M. A. Legoux, proposes to consider the general case of curves of the order δ. The three sides of the triangle of reference are tangents to all the curves of the system in the points where these sides meet the line u. The order of contact is $\delta - 1$: if δ is even, the curve in the neighborhood of the point of contact lies on one side of the tangent; if δ is odd, the curve here cuts the tangent, giving a point of inflection of a higher order. M. Legoux shows that the proposed curves have imaginary points of inflection, which are distributed upon two conjugate imaginary right lines which are independent of the value of k. If δ is even, there are no other inflections; but, if δ is

odd, there exist three real points of inflection upon the line u, so that in the last case there exists, as in the case of cubics, an inflectional triangle. — (*Nouv. ann. math.*, Feb.) T. C. [105

ENGINEERING.

Electric-lighting machines on shipboard. — More than a dozen of the steamers plying between New York and Liverpool are fitted up with electric-lighting machinery. Probably three times as many are so fitted out on the various other lines of ocean-going steamships. The British steamers are largely supplied with the Siemens and Swan apparatus, but the other systems are well represented. The electric-light apparatus of the Arizona consists of two Siemens compound dynamos, each sufficient to supply current to three hundred high-resistance Swan lamps. They are driven by a pair of 'Caledonian' engines of nine and a half inch cylinders and fourteen inches stroke of piston. The two machines are mounted upon a common foundation, and are set in such manner that the driving-pulleys do not interfere with each other. The belts are tightened by moving the machines away from each other; they are formed of one continuous rope carried around each pulley ten times. Both cabins, and the steerage as well, are lighted by these machines. — (*Engineering*, May.) R. H. T. [106

New engine for electric-lighting. — Mr. E. D. Farcot has designed a new form of compound engine for electric-lighting machinery. It consists of two cylinders, the larger set above the smaller. The space between the two pistons is undivided, and is in communication with the interior of the engine-frame, and is never put in connection with the steam-supply pipe. The steam first enters the small cylinder, and is thence exhausted into the large cylinder, thus driving the pistons, which are both on a single rod, in opposite directions by a system of intermitted expansion. The engine is thus seen to be of the 'Wolff system.' The space between the two pistons is made to communicate with the larger space in the frame, merely to secure a reduced variation of uncounterbalanced pressure. No stuffing-box is needed in this engine in any inaccessible part of the machine. The valve-gear is of the plainest possible description, and the whole engine is built with a view to simplicity and small cost in construction and operation. It is intended to be driven up to four hundred revolutions per minute. — (*Publication industrielle*, May.) R. H. T. [107

Steam-jackets for steam-engines. — Herr Heim reports to the German society of engineers the results of experiments to determine the economy to be derived by the addition of steam-jackets to various forms of steam-engine. He finds that a six-horse power portable engine, unjacketed, demanded an excess of thirty-five per cent over the theoretical quantity of steam that should have been required to do the work; an eighteen inch Wheelock engine required the same excess over the calculated quantity. Both were non-condensing. Condensing-engines experience a still greater loss due to internal 'cylinder condensation.' Engines expanding ten times demand seventy-four per cent excess; when cutting off at one-fifth, sixty-two per cent; and expanding three times, fifty-five per cent more than the calculated amount when they are unjacketed. By adding a jacket, he concludes that the loss can be reduced to sixty-four, fifty-four, and forty-eight per cent. The effect of increase of piston speed is similar to that of adding a jacket. An engine at three feet, and at seven feet piston speed per second, gave a record of loss amounting to ninety-six and seventy per cent. The addition of the condenser causes increase of this loss. A twenty-inch non-condensing engine, working at five atmospheres pressure, was provided with a condenser, and, while the power was increased one hundred and forty per cent, the waste was increased from forty-two to sixty-two per cent. A hoisting-engine, working intermittently, exhibited a loss of a hundred and forty-two per cent of the weight of steam utilized. — (*Mechanics*, June.) R. H. T. [108

AGRICULTURE.

The gases evolved during the conversion of grass into hay. — In a series of experiments on this subject, conducted by Dr. P. F. Frankland and Mr. F. Jordan, freshly-cut grass in quantities of five grams each was allowed to stand in a glass tube over mercury. The glass tube was filled with air, inert gases, and experiments were also performed *in vacuo*. In air all the oxygen was absorbed at the end of three days, and 46% of carbonic dioxide was evolved. At the end of thirty days the percentage of carbonic dioxide reached 85.33, requiring a corresponding amount of oxygen, which must have come from the substance of the grass itself. Nearly pure carbonic dioxide was evolved in an atmosphere of the same gas, and a higher percentage seemed to be given off in darkness than in sunlight, although the authors were somewhat in doubt on this point. In an atmosphere of pure oxygen, the latter was absorbed completely in seven days, and the evolution of nitrogen ceased when the oxygen disappeared. When the experiment was conducted in an atmosphere of hydrogen, 21.11% of this gas was replaced by carbonic dioxide at the end of three days. It thus appears that certain constituents of the grass undergo a rapid process of oxidation, and that nitrogen is evolved as long as the atmosphere contains free oxygen. The decomposition-products of grass, when allowed to stand under water, were also examined. The grass was first soaked in distilled water, and the dissolved air removed with a Sprengel pump. Carbonic dioxide formed about 90 %, and hydrogen about 9 %, of the gases collected at the end of thirty days. No gas was evolved when the formation of bacteria was prevented by the addition to the water of phenol or mercuric chloride. As the other products of the fermentation, acetic and lactic acids, and probably propionic acid, were identified. — (*Journ. chem. soc.*, June, 1883.) C. F. M. [109

Absorption of moisture by soils. — Fisher finds that, contrary to Knop's statement, the amount of hygroscopic moisture retained by a soil varies greatly with the amount of moisture present in the air, as

well as with the temperature. At temperatures ranging approximately from 20° to 30° C., about half as much water was retained in a half-saturated as in a saturated atmosphere. As the temperature was raised, more water was absorbed from the saturated atmosphere, but less from the half-saturated one. — (*Rep. Cal. college agr.*, 1882, 52.) H. P. A. [110

Influence of organic manures on temperature of soil. — In experiments on this subject, F. Wagner finds that organic manures raise the temperature of the soil to an extent increasing with the quantity of the manure, the temperature of the soil, and its moisture, so long as the latter is not in such excess as to hinder access of oxygen to the organic matter, or to cool the soil too much by its evaporation. Porosity and ready decomposability on the part of the manure favor the action. The increase of temperature is greatest at first, may continue from four to twelve or more weeks, but under practical conditions is too small to be of much significance. — (*Forsch. agr. phys.*, v. 373.) H. P. A. [111

Moisture of the soil. — In pot-experiments with peat, Heinrich obtained the largest crop when the peat contained sixty per cent of the total quantity of water which it was capable of containing. Earlier experiment by Hellriegel on sandy soil gave nearly the same results. When the moisture of the peat fell below twenty per cent of its water-capacity, no crop was obtained, while in case of sand a small crop was obtained when the moisture was only ten per cent of the total water-capacity. — (*Bied. centr.-blatt.*, xii. 109.) H. P. A. [112

GEOLOGY.

Lithology.

Cleopatra's Needle. — In a paper by Dr. P. Frazer is given a description of some thin sections of the New-York obelisk, made by Prof. A. Stelzner of Freiberg, accompanied by four lithographic plates. The rock is composed of fresh microcline, showing in polarized light its characteristic grating; oligoclase, somewhat decomposed, and showing fine twinning striation; quartz in grains and granular aggregates, containing fluid cavities, trichites, and hematite plates; light green hornblende with irregular outlines; biotite in large brown, translucent scales; titanite in numerous small yellowish-red grains; water-clear acicular apatite crystals; magnetite in opaque irregular grains and in octahedrons; minute zircon crystals; yellowish-green needles of epidote and viridite. A granite from Germantown was regarded as similar to the Syene granite. The former is composed of microcline, plagioclase, quartz, hornblende, biotite, muscovite, titanite, etc. Frazer gives the literature of the subject. — (*Trans. Amer. inst. min. eng., Boston meeting.*) M. E. W. [113

Journalistic lithology. — A weekly journal was established last year in England on the peculiar plan of publishing descriptions of microscopic slides, with figures of the same, while duplicates of the described preparations were to be sent to every subscriber. This method, if under the direction of competent specialists, would serve as a valuable means of home training for those who are unable to place themselves under the direct instruction of competent teachers. It promised twenty-six histological, eighteen botanical, and eight lithological sections a year.

The lithological descriptions, so far, have embraced the following rocks: pikrite, dolerite, diabase, red and white syenite, and serpentine, with some bibliographical lists. While the journal contains some matter of interest to lithologists, it is, on the whole, a disappointing and unsafe guide for a student. In some cases the style of the lowest grade of 'popular scientific lecturers' has been adopted; and the phrase 'plugs of exosmotic transference,' used for veins, is too good to be lost. — (*Studies in microscopical science, London*, 1882–83.) M. E. W. [114

METEOROLOGY.

Sun-spots. — At the university observatory at Rome on 269 days in 1881, and 290 in 1882, Tacchini has made observations of sun-spots. He shows that in 1882 there was an increase in spots over 1881. The mean daily number by months was, in 1881, 19.55, and, in 1882, 22.57. There were peculiar maxima in the number in April and November, 1882. Taking each period of constant activity in the daily observations in 1882, a second maximum and minimum period appears at the half sun's rotation. For the faculae we also find that the increase is less with the growth of the spots; the yearly mean in 1881 being 88.36, and, in 1882, 81.55. It is believed from the character of the sun's activity at the last maximum period, as compared with the present, that the maximum spottedness will occur in 1883. — (*Naturforscher*, May 12.) H. A. H. [115

PHYSICAL GEOGRAPHY.

Artesian wells in Algeria. — In the south of the province of Constantine, Algeria, the boring of artesian wells, begun in 1856, was continued with renewed activity, after the interruption occasioned by the Franco-Prussian war, under the direction of M. Jus. At the end of 1879 the long line of wells following the Wady Rir, between Biskra and Tugurt, included 434 sunk by the Arabs, and yielding 64,000 litres a minute, and 68 bored by the French, yielding 113,000 litres. In the same decade, the number of palm-trees in the oases had increased from 359,000 to 517,000; of fruit-trees, from 40,000 to 90,000; of inhabitants, from 6,672 to 12,827. During the first half of 1880, twelve new wells were bored, yielding 22,000 litres, and, at the end of 1881, the total supply of water from these underground sources was 209,000 litres a minute. — (J. J. Clamageran, *Rev. géogr. internat.*, 1883, 43.) [116

Currents of the Pacific Ocean. — Antisell discusses the general motion of the warm currents of the western and northern Pacific, brings together a number of data not before correlated, illustrates them by maps and diagrams, and comes to the conclusion that, 1°, the warming influence of the North Pacific is the Kurosiwo, the motor power of which is the south-west monsoon, blowing from April to October; and, 2°, that the North Pacific Ocean has practically

no northern outlet, Bering Strait affording no real access for ocean-currents into the Arctic Ocean. — (*Bull. Amer. geogr. soc.*, ii. 1883.) W. H. D. [117

The Connecticut River in the glacial period. — Professor J. D. Dana continues his studies on the former lines of flow of the flooded Connecticut at the end of the ice time, and finds evidence, from the height and coarseness of the terraces, that some of the river's waters found their way southward along the Farmington valley (where the Farmington River now runs northward), down the upper course of the Quinnipiac, and thence directly southward along the present Mill River channel, to the Sound at New Haven, and not all the way along the Quinnipiac, as was formerly supposed. — (*Amer. journ. sc.*, xxv. 1883, 440.) W. M. D. [118

GEOGRAPHY.

(*Asia.*)

New Guinea. — A ten-days' trip inland from Port Moresby, made by W. G. Lawes and two others, with a party of natives, led them over the Veriata Mountain, about two thousand feet high, and up the valley of the Laloke River. From the mountain-summit, they had a fine view of sea and coast, hill and valley, intersected by many winding streams. In the valley, they visited the Rouna Falls, — about two hundred and fifty feet in height, and a hundred and fifty feet wide. The travellers saw many of the natives of the Koiari tribes, and found them all friendly and honest. They are smaller, darker, and more hairy than the coast tribes, and it was not uncommon to find a man with beard and mustache. They have a superstitious belief, that, when a man dies, he has been bewitched by a spirit belonging to a neighboring tribe, who then must pay for the loss: fighting, therefore, always follows the death of a man of any consequence. Fruit is very plentiful and in great variety. Salt is highly prized, and makes a very acceptable present. The native method of getting fire is peculiar: a piece of dry, pithy wood is split a little way, and held open with a stone; some tinder is put in the cleft, and a strip of rattan or bamboo is passed through it, and then pulled rapidly one way and the other till smoke and fire appear. In the 'Sogere' district, the villages consist of only eight or ten houses, and two or three 'tree-houses' which serve as forts. The occupants prepare for an attack by carrying up a supply of stones into the tree-houses; and as they are sometimes over one hundred feet high, and command the whole village, they are not easily taken. Travelling was not easy, as there were numerous streams to cross, and leeches were very plentiful in the wet grass. — (*Proc. roy. geogr. soc.*, v. 1883, 355.) W. M. D. [119

Indian surveys. — A general report on surveys in India during 1881-82, by Gen. J. T. Walker, announces the completion of the triangulation of all India on the lines long ago marked out by Col. Everest and sanctioned by the East India company. The latest part of this Great trigonometrical survey was the eastern frontier series of triangles extending from Assam to Tenasserim, where it was brought to a close on a base line of verification at Mergui. The topographical survey has continued its work in various parts of the peninsula, turning out maps on several scales embracing nearly twenty-five thousand square miles, besides forest and town surveys on large scales. A new survey of the Hoogly is begun, as the existing maps are out of date and on too small a scale for utility in so densely populated and valuable a region.

The chief geographic interest in the volume is found in the reports on trans-Himalayan explorations by trained native travellers, and in the reports of various executive officers of the survey on their districts. — (*Proc. roy. geogr. soc.*, v. 1883, 368.) W. M. D. [120

BOTANY.

Cryptogams.

New Ustilagineae. — Cornu gives an account of the anatomy and germination of the spores in several curious Ustilagineae. Ustilago axicola, Berk. and Curt., is made the type of a new genus, Cintractia, characterized by the formation of the spores in successive concentric circles. The curious Testicularia Cyperi from the United States is figured, and a second species of Leersia is described. The new genus Doassansia, in which the spore masses are surrounded by a peculiar envelope, has one representative from North America which is figured by Cornu. — (*Ann. sc. nat.*, xv. 269.) W. G. F. [121

Zygospores of Mucors. — Bainier has studied the conditions which favor the production of zygospores in Mucors, and finds that the conditions vary in the different species. The absence of free oxygen or of light is not a necessary condition, nor is a deficient supply of nourishment always required for the production of zygospores. Bainier cites a considerable number of cases where he has cultivated different species, and gives the manipulations required in each case for securing sporangia and zygospores; and he adds some observations on the chemical action of certain species. It appears that Phycomyces nitens, which usually grows on fatty substances, which it decomposes, can also be cultivated on cochineal, causing it to assume a deeper color, and rendering it more valuable commercially. Mucor racemosus, and a new species, M. tenuis, are described and illustrated in full. — (*Ann. sc. nat.*, xv. 342.) W. G. F. [122

Phenogams.

Lignification of epidermal membranes. — Besides cutinization, the change which characterizes epidermal cell-walls in general, the exposed wall may undergo two others: it may be converted into mucilage, thereby becoming weakened, or it may be rendered firm by the deposition or infiltration of mineral matters. To these well-known transformations of epidermal cells, Lemaire now adds *lignification*, hitherto supposed to be confined to internal tissues. For the detection of lignine, he uses the useful reagent suggested by Wiesner, phloroglucine. A section of epidermis is transferred from an alcoholic solution of the agent to hydrochloric acid, when the lignified membranes assume a rose color, the other parts re-

maining unchanged. For purposes of control, similar sections are first treated with either nitric acid or a solution of bleaching-powder, by which reagents, preferably the latter, the lignine is removed. Lemaire has detected lignine in the epidermal walls of Cycads, many Coniferae, and in the petiole of certain ferns. The stomata of gymnospermous plants have been found by him to always have the membranes somewhat lignified. — (*Ann. sc. nat.*, XV. 302.) G. L. G. [123

Mentzelia laevicaulis as a fly-catcher. — Marcus A. Jones of Salt Lake City, acting upon Dr. Gray's suggestion, examined this plant with the following interesting results: "the leaves are thickly beset with coarse hairs, which are furnished with several pairs of barbs pointing downward along them, while the top has an anchor-shaped summit twice as large as the other barbs. These hairs stand so close together that the barbs almost touch. Thickly studding the leaf, were many dead and dying mosquitoes, species of aphis, and other small insects. Some of these were caught by the head; but most of them were held by the proboscis, as their heads were too large to slip between the barbs. All were more or less mutilated, probably by other insects. A sweet fluid was secreted by the leaf, and this attracted the insects. There was no evidence of any digestion going on, as none of the victims could get close enough to the surface of the leaf to be touched by the fluid." — (*Bull. Torrey club*, June.) G. L. G. [124

Elongation of pedicels in Didymoplexis. — Hemsley calls attention to the elongation of the pedicels in these Asiatic orchids after fertilization, by which the ripening capsules are carried up above the decaying vegetable matter in which the plants grow. It is thus quite different from the elongation of the flower-stalks of Arachis and other plants which bury their ripening fruit. What its exact bearing on dissemination may be is not quite clear. — (*Journ. Linn. soc. bot.*, June 6.) W. T. [125

ZOÖLOGY.

Mollusks.

Mediterranean Mollusca. — Dr. J. Gwyn Jeffreys publishes a useful annotated list of species obtained near Crete by Admiral Spratt in seventy to a hundred and twenty fathoms. They are mostly quite minute. Ten new species are described and well figured. One, an extremely minute shell, which might well prove the fry of something larger, is globosely conical, imperforate, and with the pillar angulated and spread out at its base. It is referred to a new genus, Brugnonia, and placed in the Solaridae. A list of Ostracoda and Foraminifera, collected with the shells, is added by Mr. David Robertson. — (*Ann. mag. nat. hist.*, May.) W. H. D. [126

Structure of the shell in brachiopods and chitons. — Van Bemmelen has prepared an English abstract of that part of his Dutch paper which relates to the brachiopods. The principal points of the dissertation are also to be found in the *Jenaische zeitschrift*, ix. h. 1–2, 1883. That part relating to the chitons, which is the more interesting because in a fresher field, has not been made available for students who do not read Dutch. The paper is decidedly sophomorical, containing much that is important but not new, and a little that is new but not important, if we except the opinions of the author. The statement that there is any difference, except in degree, between the structure of the peduncle in Lingulidae and in other brachiopods, will require much more demonstration before it can hope to be accepted; and the principles upon which he includes the greater in the less by placing brachiopods among the chaetopods, would, if carried to their logical conclusion, include man among the Ascidians. — (*Ann. mag. nat. hist.*, May.) W. H. D. [127

Economic mollusks at the Fisheries exhibition. — The catalogue of the economic mollusks exhibited by the U. S. fish-commission at London, prepared by Lieut. Winslow, U.S.N., has just appeared, and forms a pamphlet of 85 pages, containing much information. — W. H. D. [128

VERTEBRATES.

Homologues of the parts of the temporal bones. — M. Lavocat, at the close of his revision of this subject, offers the following conclusions: —

1. That the relations of the squamosal and the zygomatic process in mammals show how ill applied to the oviparous vertebrates are the terms 'tympanic bone' (*os tympanique*), generally applied to the squamosal, and 'squamous portion of the temporal' (*écaille temporale*), given to the zygomatic process. In the oviparous vertebrates the tympanic bone does not exist. 2. That the zygomatic process, always included between the squamosal and the jugal, should never be confounded with the squamosal. 3. That there is a vulgar error relative to the temporal of serpents, in which the superior part of the squamosal has been considered to be the mastoid; while, in reality, the mastoid is invariably situated above or behind the auditory cavity, and is never movable. 4. That in birds the squamosal cannot be represented by the posterior frontal, because the latter is orbital in its relations, while the former is temporal; also that the zygomatic process should not be confounded with the jugal, the one having relations with the squamosal, the other with the maxillary.

The author also states concisely that that bone must be considered the squamosal which, though fixed or movable, is situated in front of the auditory canal, and articulates with the pterygoid and the mandible. In the oviparous vertebrates, the squamosal has commonly been wrongly designated 'the tympanic.' The zygomatic process, whether fixed or free, is always included between the squamosal and the malar. The parts of the temporal are also clearly distinguishable by their teleological relations.

The author furnishes the data for the table (see p. 114) of the synonymy of the temporal bone in the fishes and lower vertebrates. — (*Mem. acad. sc. Toulouse*, iv. 1882, 71.) F. W. T. [129

Nomenclature of the squamosal bone (temporal écailleux) of the Vertebrata pisciformes.

Lavocat.	Cuvier.	Owen.	St. Hilaire.	Agassiz.	Vogt.	Bojanus.	M.-Edwards.	Bakker.	Rosenthal.	Hallman.
Pièce supérieure.	Temporal.	Epitympanic.	Sérial.		Caisse ty	mpanique.	Epitympanique.	Symplecticum primum.	Os carré.	
									[Carus.]	
Pièce inférieure.	Jugal.	Hypotympanic.	Hypocotyléal.	Os c	arré.	Ptérygoïde interne.	Hypotympanique.	Symplecticum quartum.	Os discoideum.	
Pièce antérieure.	Tympanal.	Pretympanic.	Épicotyléal.	Caisse.			Pretympanique.			Ptérygoïde postérieure.
										[Meckel.]
Pièce postérieure.	Symplectique.	Mesotympanic.	Uro-sérial.				Mesotympanique.	Symplecticum secundum.		Styloïde.

ANTHROPOLOGY.

Domestication of the horse. — M. Cornevin, discussing the earliest evidence of taming the horse, very pertinently sets out with the question, "What is a domestic animal?" and replies, "One that participates in the *domus*, submits itself to the domination of a master, to whom it renders its products or its services, reproduces in captivity, and gives birth to young, which become more and more submissive to control." The idea of domestication comports with that of property in some form. M. Cornevin, for reasons mentioned in his communication, places the time of the event in the bronze age contemporaneous with the bronze bit. The fact seems incontestable that the use of bronze was imported into Europe and Africa from the orient. M. Pietrement, in his work on the origin of the domestic horse, and, before him, M. Pictet, in his *Origines indo-européennes*, have proved that the Aryans, of the central Asiatic plateau, utilized the horse at a time when Europe was in the stone age. In the discussion which followed M. Cornevin's paper, M. Faure remarked, that, while the bronze bit was good proof of the domestication of the horse, the latter may have been tamed long before bronze was known. Indeed, the Gauchos catch the wild horses with a simple lasso. Could not prehistoric man, after catching a horse by means of a lasso, like the Gauchos, have made a simple bridle of raw hide, and have managed the animal thereby? — (*Bull. soc. anthrop. Lyon*, i. 116.) J. W. P. [130

The troglodytes. — M. Alex. Bertrand, conservator of the museum of national antiquities of St. Germaine-en-Laye, delivered an address in December last on the cave-dwellers, now published with copious illustrations in the first part, vol. ii., of the *Revue d'ethnographie* (Jan.–Feb., 1883). The address is in popular language, and gives many valuable particulars, deduced from their remains, of the environment, habits, utensils, and art of the prehistoric inhabitants of Europe. Perhaps the most interesting points are the evidences presented of their domestication of the reindeer, and the parallel drawn between their supposed mode of life and that of the modern hyperboreans. — J. W. P. [131

The Serers of Joal and Portudal. — Dr. A. Corre of the French marine service gives an interesting and illustrated ethnographic sketch of the remarkable people on the west coast of Africa, chiefly near Cape Verd, and mentioned by Brue, towards the end of the seventeenth century, as being strongly distinguished from the surrounding negroes. In many particulars, these people show characteristics similar to those of tribes separated from them by half the circumference of the globe. A short sentence may be literally translated in illustration: "They call the uncle, father; the aunt, mother; the cousins, male and female, brothers and sisters." The writer of the sketch did not appear to understand, or at least to follow up, this evidence of the system of consanguinity and affinity so frequently found in the stage of savagery. — (*Rev. d'ethnographie*, Jan.–Feb., 1883.) J. W. P. [132

Roumanian ethnology. — Trajan conquered Dacia in A.D. 106, colonizing it with subjects drawn from various parts of the empire. When this same country became known to the inhabitants of western Europe, they found there a people speaking a language derived from the Latin, and evidently descended from Roman provincials. With their imperfect knowledge of the intervening centuries, it was but natural, says A. J. Patterson, that they should connect these facts together, and assume that the Wallachs of their own times were the direct descendants of Trajan's colonists, and that they had dwelt uninterruptedly on Dacian soil. As soon, however, as the Rouman language and Rouman institutions

were examined in detail, more and more points were discovered which could with difficulty be brought into harmony with that *prima facie* view. Inquirers who were not subject to the disturbing influence of Rouman patriotism came to the conclusion that the present Romance-speaking population of Roumania and Transylvania have migrated thither from the lands south of the Danube since the beginning of the twelfth century. In addition to the ordinary ethnologic evidence, the philological argument has been effectually urged by Paul Hunfalvy. Both in the middle ages and at the present time, a people is found in various parts of the Balkan peninsula whose speech so closely resembles that of the northern Roumans as to prove that they are dialects of one language, and must have been diffused from a common centre. — (*Academy*, May 19.) J. W. P. [133

NOTES AND NEWS.

It was known some months since how Mr. Henri Harrisse had made, as he claimed, a discovery that the Portuguese had as early as 1502 mapped out the eastern seaboard of the present United States from Florida to the neighborhood of 40° north latitude. A few weeks ago Mr. Harrisse laid a copy of the discovered map before the French institute with documentary proof of its date (1502). A more particular statement has reached us in a letter from the Rev. Edward E. Hale, written in Paris, where he had inspected Mr. Harrisse's copy of the map and document which were found in the archives of the Este family in Modena. We must await conclusive particulars, to be published by Mr. Harrisse, before determining if this last be one of the important contributions to the study of early American cartography, which this whilom New-York lawyer has made. Meanwhile it is not at all clear whether the new map is going to contribute any thing further than what we have already known from the old Portuguese chart, which Lelewel gives in his *Géographie du moyen âge*, pl. 43, with a conjectural date between 1501 and 1504. This gives a rude representation of Florida, with its easterly coast trending northerly, and coming abruptly to an end. Lying to the north-east, and in mid-ocean, is a bit of continental shore, indicating the Cortereal discoveries in its latinized name, 'Regalis domus,' with a large island adjacent called 'Terra laboratorum,' or Labrador. The earliest printed map of this region bears a strong resemblance to the Portuguese chart, and would seem to have been based on the same or similar information; and this is the famous Stobnicza map, which was published at Cracow not far from 1512. The 1511 Ptolemy has the Cortereal region, but omits Florida. From two maps in the 1513 Ptolemy a delineation very like the Portuguese chart can be made up; and after this its contours became for some years an established type frequently met with. Another Portuguese chart is well known to students in this field; and that is the one which has been reproduced by Stevens, Kunstmann, Kohl, and others, and is usually placed between 1514 and 1520. If it embodied current knowledge in Portugal, it was certainly not generally known there that the eastern coast united with the Cortereal region; for the ocean is represented as washing uninterruptedly between.

From what Mr. Hale writes, the newly found map would seem to be much the same in character as the 1513 printed Ptolemy maps, thus carrying back their delineation ten or eleven years earlier; and this, we have seen, takes us to the supposed date (1501–1504) of the Lelewel Portuguese chart, which is essentially like the 1513 maps, and seemingly like the Este map: but a sight of Harrisse's discovered chart, in due time to reach us, will give us something more than conjecture on which to base an estimate of its importance.

There is one discovery, however, which we are waiting for, and in time it may come; that is, the evidence, cartographical we hope, rather than documentary, that the Biscayan fisherman knew the Grand Banks and the adjacent coasts long before Columbus. It seems harder not to believe that this was the case than to believe it. The hardy fishermen of the Bay of Biscay had stretched their courses farther and farther to the north in pursuit of the stock-fish or cod, which was the staple food of Catholic Europe for more than a hundred days in the year. They had gone to Iceland, and, by easy gradation, to the Greenland seas; and we must remember that on this very Portuguese chart of 1501–1504, and in the Ptolemy, preceding the time of Columbus, Greenland was but a prolongation of north-western Europe. Accordingly, following their game, the fishermen could easily have cruised still farther along the Labrador coast, and to the neighborhood of Newfoundland, without in the least supposing they had found a new world, but rather a hitherto unvisited region of the old world. So, on their return, their sailor's yarns would raise no suspicion of a new quarter of the globe, such as Europe was startled at when Columbus returned from his purposed quest. It was not the fishermen's report, accordingly, that could have incited Cabot; but, when news reached England of the discovery of the Spaniards, it can easily be conceived how these sailor's yarns may have been interpreted in the belief that the land found by Columbus must, by the analogy of continents, have stretched to the north, and could be found by sailing west from England. Further, so far as Columbus' views were shared, that he had reached the coast of Asia, the reports of Marco Polo and the rest showed that the Asian coast must lie also in that very direction. Now, when Cabot reached the land, and found the natives calling the stock-fish or cod, *baccalaos*, where did they get the very term which Biscayan fishermen had applied to the same fish for centuries? This has always been a puzzle. It seems to us that it will yet be discovered that Cabot had only reached by a southern passage the region which the Biscayans had long been sailing to by the northern. The archives of Europe, we are confident, will yet reveal the proof. Only last summer the Rev. Mr. Hale, searching the archives at Madrid, found a sketch by Cortes

of the Gulf of California, made six years before the earliest that had previously been known; and it disclosed the extent of Cortes' own examination of the Pacific coast in advance of his captains. The archives of the old world have by no means yet yielded all that they may.

— The funeral of the late Mr. William Spottiswoode took place at noon July 5 in Westminster Abbey, and was attended by many distinguished men from the various scientific and other societies with which the deceased was connected. There was also a large attendance of the general public. The pall-bearers were Marquis of Salisbury, Oxford university; Lord Granville, London university; Sir W. Siemens, British association; Sir F. Leighton, Royal academy; Sir J. Lubbock, Linnaean society; Sir Bartle Frere, Royal Asiatic society; Sir W. Armstrong, Institute of civil engineers; Dr. Evans, Royal society; Chancellor of the exchequer, H. M. government; Duke of Northumberland, Royal institution; Master of the stationers' company, the company; Lord Aberdare, Royal geographical society; G. Busk, Esq., Royal astronomical society; Professor Flower, Zoölogical society; Mr. Shinn, Mr. Carey, Mr. Hunt, Mr. Millwood, Mr. White, Mr. Wilson, representing departments in the Queen's printing-office.

The *Athenaeum* says of Mr. Spottiswoode: "Mr. W. Spottiswoode's illness had from the first caused serious alarm; still it was hoped that he would triumph over typhoid-fever, though complicated by congestion of the lungs. His strength had, however, been shaken by the severe accident he met with some months ago, and there is little doubt that his indefatigable attention to duties of various sorts had overtasked even his vigorous constitution. He combined with the studies of a physicist and a mathematician the supervision of a great mercantile concern. To accomplish all this; to make elaborate and delicate experiments, contribute a succession of papers to the *Transactions* of the Royal society and *The Philosophical magazine;* to mix frequently in general society; to preside over the chief of our scientific bodies, and manage a large business, — was possible only to a man who would map out the work of every day, and never waste a minute of his time. And this was the case with Mr. Spottiswoode. His was eminently an organizing brain, gifted with great clearness, complete mastery of detail, unfailing punctuality, and power at once to seize the essence of any matter brought under his notice. Personally he was most kind and generous, eminently tolerant of differences of opinion, and courteous to all with whom he came in contact."

— On Thursday night, July 12, 1883, the newer of the buildings of the Indiana university was struck by lightning and thoroughly destroyed. The building was a four-story brick of Gothic design. Upon the first floor were the collections of geology, mineralogy, and archeology, and the chemical laboratory; on the second floor were the libraries and the physical laboratory; while the third contained the valuable zoölogical collections of the university, and the museum of comparative anatomy. The loss as reported is as follows: museum, $75,000; library, $36,000; laboratory, $10,000; building, $45,000; total, $166,000; upon which there was a total insurance of $27,454.54.

The entire Owen collection of 85,000 specimens of geology and mineralogy was destroyed. This collection contained many types of species described by David Dale Owen and others. The geological collection also contained many noted specimens from Europe and America, among the more celebrated of which were the large Würtemberg Ichthyosaurus, and a Megalonyx from Henderson, Ky. The latter has fortunately been described and figured by Professor Cope for the forthcoming report of the Indiana geological survey. A fine set of Ward's casts was also destroyed, but can readily be replaced.

Professor Van Nuys' chemical laboratory, containing a number of fine imported pieces of chemical apparatus; Professor Wylie's physical laboratory, including a number of the owner's ingenious mechanisms, and the entire ichthyological collections of Professors Jordan and Gilbert, — representing years of patient work, and probably the finest private collection of fishes in the United States, — were also destroyed, together with valuable collections belonging to the U. S. national museum, Yale college, Cornell university, and other institutions.

The Brookville society of natural history, of Brookville, Ind., has been the first to offer aid to the institution: they have placed their entire collection of duplicates at the service of the trustees, from which several thousand specimens will be received as soon as arrangements can be made to accommodate them. It is understood that the trustees will proceed at once to replace the building which was destroyed; and they should erect a substantial fire-proof building in which to keep what valuable material they may hereafter acquire.

— The circular of the local committee of the American association announces reduced rates on very many railways and at the hotels of Minneapolis. The latter, however, are crowded at this season; and members are recommended to resort to the suburban hotels on Lake Minnetonka and Lake Calhoun, about twelve miles from the city, to and from many of which the railways will carry members free, the time being about half an hour. Many members will be entertained by the citizens of Minneapolis; and a sub-committee will endeavor to find entertainment for all who will notify its chairman, Hon. A. C. Rand, early, of their intention to be present.

The usual favors will be granted by the telegraph companies. Badges, a daily lunch, and low-priced carriages will be furnished, together with a descriptive and illustrated guide to the city of Minneapolis, now in preparation. Express packages containing apparatus, specimens, maps, books, drawings, or other articles designed for use in the meetings, will be forwarded by the American express company, and delivered free of charge at the University of Minnesota. Such parcels should be addressed in care of Prof. J. A. Dodge, to whom, also, all correspondence relating to the same should be sent. After Aug. 12,

letters may be addressed to members at Minneapolis, in care of the association, and they will be delivered from the office of the local committee at the university.

An excursion will be made to Minnetonka, and return, on Saturday afternoon, when a lawn picnic will be served at the Lake Park Hotel. If a party of a hundred and fifty or more desire to make an excursion to Winnipeg, and return, at one-half of regular fare, the St. Paul, Minneapolis, and Manitoba railway will send a special train for their accommodation. No definite arrangements have yet been made for other excursions.

The retiring address of President J. W. Dawson will be given at the Westminster church, on Nicollet avenue, on Wednesday evening. After the address a reception will be held by the local committee at the Nicollet House.

The meeting will probably be one of special interest to glacial geologists, numerous papers concerning the terminal moraine and other glacial phenomena being expected.

— The annual meeting of the Society for the promotion of agricultural science will be held in Minneapolis on Aug. 13 and 14, in the Agricultural college building, of the State university.

— A special public meeting of the Cambridge entomological club will be held in Minneapolis, at the chapel of the university, at two P.M. on Tuesday, Aug. 14, to which all persons interested in entomology are invited.

— The annual meeting of the American forestry congress will be held at St. Paul, Minn., commencing on Wednesday, Aug. 8, 1883. The local committee has in charge the arrangement of railroad facilities, etc., announcement of which will be sent to all members in due time, and to all those who express their desire to attend the meeting. Papers to be read at the meeting, or abstracts of the same, should be sent in to the corresponding secretary two weeks before meeting, according to the by-laws of the congress.

— A geographical and ethnological exhibition will be held in Nancy from Aug. 20 to Sept. 20.

— The French association for the advancement of sciences meet at Rouen, Aug. 16–23.

— The sixth congress of the French geographical societies will meet under the presidency of M. de Lesseps at Douai on the 26th of August, and remain five days in session. A geographical exposition will form a feature of the meeting. The seventh congress will meet at Rouen in 1884, and the eighth at Oran in 1885.

— The seventh congress of the Russian scientific association will be held in Odessa from Aug. 30 to Sept. 9.

— The sixth annual meeting of the American society of microscopists will be held in Chicago, beginning Tuesday, Aug. 7, 1883, and continuing four days. Ample preparations are making by the committee of the State microscopical society of Illinois, and the Chicago academy of sciences; and the attendance of members is expected to be larger than ever before. First-class hotel accommodations at reduced special rates have been secured, and choice arrangements made for the comfort and convenience of the meeting. Titles of papers may be sent to the secretary, Prof. D. S. Kellicott, Ph.D., 119 14th St., Buffalo, N.Y. Full provision will be made for illustration, by projection apparatus, of any article when the authors may so desire. A special hour will be allotted each day to the exhibition of objects and apparatus referred to or described in communications read before the society; an evening will also be set apart for the presentation of methods of work, including staining, section-cutting, mounting, microphotography, etc. A general microscopical *soirée* will be held on another evening, and members are requested to bring instruments and slides with them. The exhibition of instruments and accessories by makers and dealers promises to be unusually fine.

The officers of the society are Albert McCalla of Fairfield, Io., president; E. H. Griffith of Fairport, N.Y., and George C. Taylor of Thibodeaux, La., vice-presidents; D. S. Kellicott of Buffalo, N.Y., secretary; and George E. Fell of Buffalo, N.Y., treasurer.

— The Société académique of Brest held an exhibition of matters relating to geography, June 3–17. An especial object was to bring to notice the rich ethnological material which has accumulated in this city during many years. The halls devoted to Japan, China, Cochin-China, and West Africa, presented much of interest.

— In the *Philosophical transactions* for 1817 (p. 325), Sir William Herschel says, that, "beside the 683 star-gauges published in the *Philosophical transactions* for 1785 (p. 221), above 400 more have been taken in various parts of the heavens."

These four hundred unpublished gauges have lately been extracted from the original observing-books preserved at the Herschel family residence at Collingwood, through the kindness of Sir William Herschel, the present baronet, and of his brother, Major John Herschel; and the manuscript has been presented to Professor Holden, director of the Washburn observatory.

The original records are in the handwriting of Miss Caroline Herschel, and by her faithful care every detail necessary to their accurate deduction is preserved. It will be observed that only two-thirds of the star-gauges of Herschel have heretofore been known. The new acquisition will be welcomed by those interested in this class of observations. They are a new gift from an inexhaustible mine.

— The bureau of education has just published a circular of information, containing the results of an inquiry into the effects of co-educating the sexes in three hundred and forty cities and large towns of the Union. Of these, three hundred and twenty-one practise co-education throughout the public-school course, seventeen co-educate for part of the course, and two separate the sexes entirely. A careful analysis of the reasons adduced for co-education enables the editor to formulate them as follows: co-education of the sexes is preferred where practised, because it is, 1°, *natural*, following the usual struc-

ture of the family and of society; 2°, *customary*, or in harmony with the habits and sentiments of every-day life and law; 3°, *impartial*, affording to both sexes equal opportunities for culture; 4°, *economical*, using school-funds to the best advantage; 5°, *convenient* both to superintendent and teachers in assigning, grading, instruction, and discipline; and, 6°, *beneficial* to the minds, morals, habits, and development of the pupils. The pamphlet concludes by observing that "both the general instruction of girls, and the common employment of women as public-school teachers, depend, to a very great degree, on the prevalence of co-education, and that a general discontinuance of it would entail either much increased expense for additional buildings and teachers, or a withdrawal of educational privileges from the future women and mothers of the nation."

— Mr. Charles B. Dyer, a well-known collector of Cincinnati fossils, died at his home on Wednesday, July 11, after a painful illness of over three months' duration. He was for many years engaged in amassing one of the finest collections of local paleontology in the country, which now reposes in the Agassiz museum in Cambridge. His rarest fossils were collected by himself, and his industry in the pursuit of new and fine specimens was untiring. In connection with Mr. S. A. Miller, Mr. Dyer issued a few years ago, at his own expense, a pamphlet with two plates, containing descriptions of new forms from his collection, entitled 'Contributions to paleontology.' Thirty years ago Mr. Dyer retired from business with a moderate fortune, and devoted all his time to collecting. He was an eccentric man, with strong feelings, but a fast friend and a pleasant companion. He was in the seventy-eighth year of his age, and had lived in Cincinnati for over fifty-five years. His name is attached to one of the commonest crinoids of the Cincinnati rocks, Glyptocrinus Dyeri, and to several very rare and beautiful forms discovered by him.

— The Imperial geographical society of St. Petersburg has awarded its great gold medal to H. W. Abich for his researches into the geology of the Caucasus. The Lütké medal was received by W. K. Döllen of the Pulkova observatory for improvements in astronomical instruments; Vitkoffski, Barsoff, and Krasnoperoff have received medals for ethnographic and statistical works; Oshanin, for travels in Turkestan, etc. Silver medals were awarded to Brunoff for meteorological researches, and to Lessar, Schultz, Gladisheff, Kiseleff, Rodionoff, and Slovtsoff for surveys and journeys, chiefly on the Asiatic frontier of Russia.

— The observatory at Moscow was among the establishments of the northern hemisphere which cooperated with Mr. David Gill, Her majesty's astronomer at Cape Town, in securing observations of the small planet Victoria, at its late opposition, for a new determination of the solar parallax. The ninth volume (livraison i.) of the *Annales* of this institution contains the results of these observations, together with several papers by its director, Dr. Bredichin, relating to comets and allied subjects.

RECENT BOOKS AND PAMPHLETS.

*** Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.*

Hospitalier, E. Formulaire pratique de l'électricitien. année i. 1883. Paris, 1883. 280 p., illustr. 12°.

Huxley, T. H. Il gambero. Introduzione allo studio della zoologia. Milano, 1883. 352 p. 8°.

Johnston's Botanical atlas; with explanatory text. 2 vols. (i. Phanerogams; ii. Cryptogams). London, 1883. 52 pl. 4°.

Jónás, J. Studien und vorschläge auf dem gebiete des lebensversicherungs-geschäftes. Berlin, 1883. 83 p. 8°.

Kloeber, C. Der pilzsammler. Genaue beschreibung der in Deutschland und den angrenzenden ländern wachsenden speiseschwämme nebst zubereitung für die küche, sowie kulturanweisung der champignonzucht. Quedlinburg, 1883. illustr. 8°.

Kobelt, W. Iconographie der schalentragenden europäischen meeresconchylien. heft i. Kassel, *Fischer*, 1883. 16 p., 4 lith. 4°.

Krok, O. B., och **S. Almqvist**. Svensk flora för skolor. i. Phanerogamer. Stockholm, 1883 26+198 p. 8°.

Le Monnier, G. Dix leçons de botanique. Paris, 1883. 124 fig. 12°.

Lepsius, R. Das Mainzer becken, geologischer beschreibung. Darmst, 1883. illustr. 4°.

Luhmann, E. Die fabrikation der dachpappe und der anstrichmasse für pappdächer in verbindung mit der theerdestillation nebst anfertigung aller arten von pappbedachungen und asphaltirungen. Wien, 1883. 256 p., illustr. 8°.

Magaud, L. Les oiseaux de la France. Première monographie: corvidés. Histoire naturelle et particulière des passereaux déodactyles cultrirostres observés en France. Paris, 1883. 4°.

Medical era. vol. i., no. 1. Chicago, *Gross & Delbridge*, July, 1883. 8+32 p. 8°. *m.*

Mina-Palumbo, F. Monografia botanica ed agraria sulla cultivazione dei pistacchi in Sicilia. Palermo, *Lauriel*, 1883. 272 p., 28 pl. 8°.

Nazzani, I. Trattato d'idraulica pratica. vol. i. Milano, *Hoepli*, 1883. 646 p. 8°.

Patouillard, N. Tabulae analyticae Fungorum. Descriptions et analyses microscopiques des champignons nouveaux, rares ou critiques. cent. i. Poligny, 1883. illustr. 8°.

Pattison, M. M. Chemists. London, 1883. (Heroes of science.) illustr. roy. 8°.

Petermann, A. Recherches de chimie et de physiologie appliquées à l'agriculture. Analyses de matières fertilisantes et alimentaires. 1872–82. Bruxelles, 1883. 448 p. 8°.

Peters, P. Darstellung elliptischer functionen durch flächen. Königsberg, 1883. 32 p. 4°.

Pucci, E. Fondamenti di geodosia. vol. i. Milano, *Hoepli*, 1883. 403 p. 8°.

Rovelli, C. La teoria delle funzione potenziale di Green applicata allo studio dei fenomeni della gravitazione universale. Como, *Franchi*, 1883. 96 p. 8°.

Saint-Lager. Des origines des sciences naturelles. Paris, 1883. 134 p. 8°.

Sauvage, H. E. La grande pêche (poissons). Paris, 1883. illustr. 8°.

Slack, J. H. Practical trout-culture. New York, 1883. illustr. 8°.

Strasser, H. Zur kenntniss der funktionellen anpassung der quergestreiften muskeln. Stuttgart, 1883. 115 p. 8°.

Targioni-Tozzetti, A. Ortotteri agrari. Firenze, 1882. illustr. 8°.

Toula, F. Geologische karte von Oesterreich-Ungarn nebst Bosnien und Herzegovina. Wien, 1882. f°.

Vallot, J. Études sur la flore du Sénégal. fasc. i. Paris, 1883. 80 p., pl. 8°. [To contain 6-8 fasc.]

Vélain, Ch. Cours élémentaire de géologie stratigraphique. Paris, 1883. 316 p., illustr. 12°.

—— Excursion géologique dans le Morvan. Paris, 1883. 129 p., illustr. 4°.

Violle, J. Cours de physique. tome i. Physique moléculaire, partie 1. Paris, 1883. 511 p., 259 fig. 8°.

Wernicke, A. Grundzüge der elementar-mechanik. Braunschweig, 1883. 448 p., illustr. 8°.

Zoltz, A. de. Principii della eguaglianza di poliedri e di poligoni sferici. Milano, *Brida*, 1883. 48 p. 8°.